MOORE INDUSTRIES

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Site-Programmable HART® Loop Monitor and Alarm

SPA

SPA *Site-Programmable HART® Loop Monitor and Alarm*

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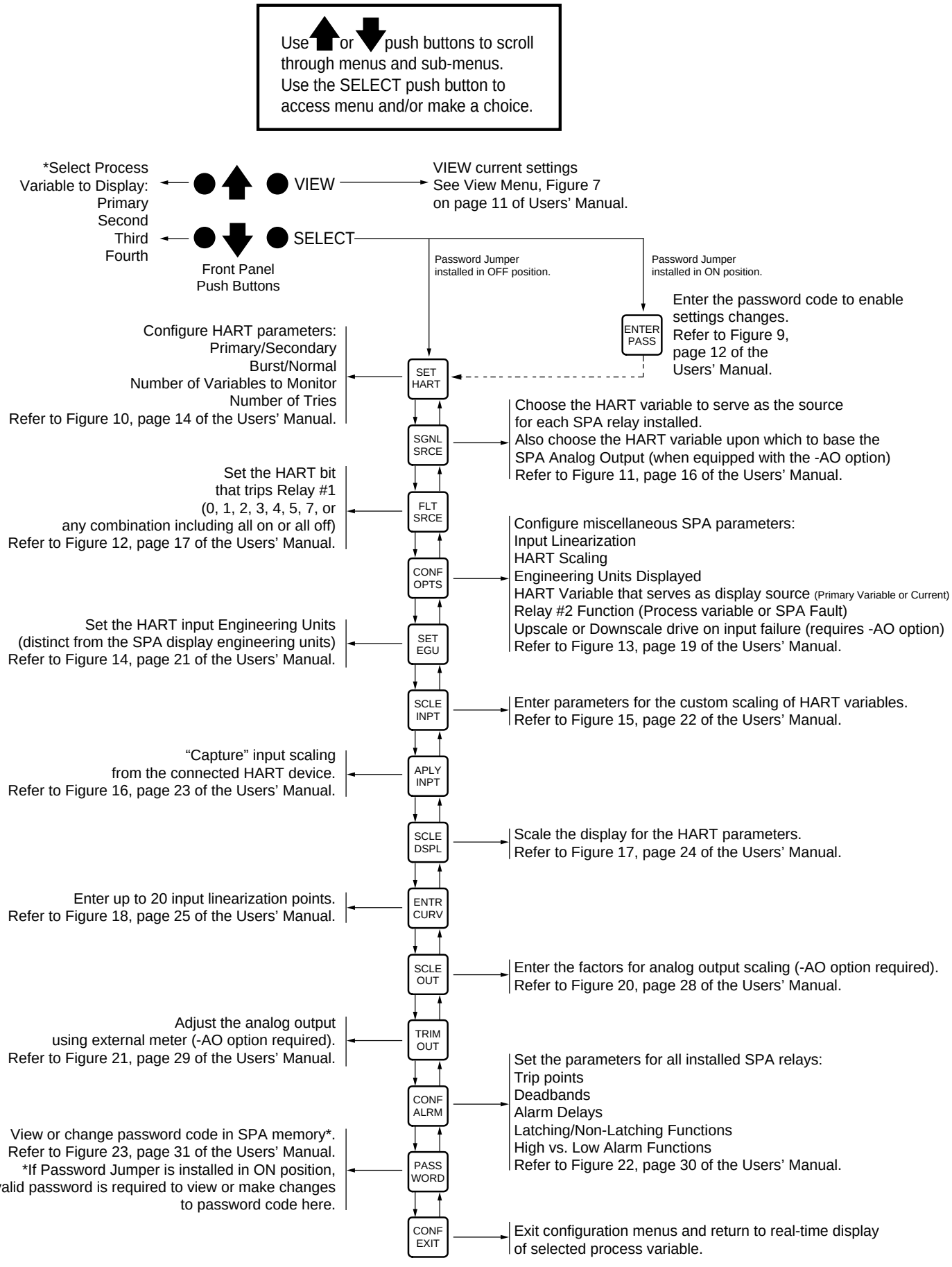
SPA HART Quickstart Menu


Use ↑ or ↓ push buttons to scroll through menus and sub-menus.
Use the SELECT push button to access menu and/or make a choice.
*Select Process Variable to Display:
Primary
Second
Third
Fourth
Front Panel Push Buttons
VIEW
SELECT
VIEW current settings
See View Menu, Figure 7 on page 11 of Users' Manual.
Password Jumper installed in OFF position.
Password Jumper installed in ON position.
ENTER PASS
Enter the password code to enable settings changes.
Refer to Figure 9, page 12 of the Users' Manual.
SET HART
Configure HART parameters:
Primary/Secondary
Burst/Normal
Number of Variables to Monitor
Number of Tries
Refer to Figure 10, page 14 of the Users' Manual.
SGNL SRCE
Choose the HART variable to serve as the source for each SPA relay installed.
Also choose the HART variable upon which to base the SPA Analog Output (when equipped with the -AO option)
Refer to Figure 11, page 16 of the Users' Manual.
FLT SRCE
Set the HART bit that trips Relay #1
(0, 1, 2, 3, 4, 5, 7, or any combination including all on or all off)
Refer to Figure 12, page 17 of the Users' Manual.
CONF OPTS
Configure miscellaneous SPA parameters:
Input Linearization
HART Scaling
Engineering Units Displayed
HART Variable that serves as display source (Primary Variable or Current)
Relay #2 Function (Process variable or SPA Fault)
Upscale or Downscale drive on input failure (requires -AO option)
Refer to Figure 13, page 19 of the Users' Manual.
SET EGU
Set the HART input Engineering Units (distinct from the SPA display engineering units)
Refer to Figure 14, page 21 of the Users' Manual.
SCLE INPT
Enter parameters for the custom scaling of HART variables.
Refer to Figure 15, page 22 of the Users' Manual.
APLY INPT
"Capture" input scaling from the connected HART device.
Refer to Figure 16, page 23 of the Users' Manual.
SCLE DSPL
Scale the display for the HART parameters.
Refer to Figure 17, page 24 of the Users' Manual.
ENTR CURV
Enter up to 20 input linearization points.
Refer to Figure 18, page 25 of the Users' Manual.
SCLE OUT
Enter the factors for analog output scaling (-AO option required).
Refer to Figure 20, page 28 of the Users' Manual.
TRIM OUT
Adjust the analog output using external meter (-AO option required).
Refer to Figure 21, page 29 of the Users' Manual.
CONF ALRM
Set the parameters for all installed SPA relays:
Trip points
Deadbands
Alarm Delays
Latching/Non-Latching Functions
High vs. Low Alarm Functions
Refer to Figure 22, page 30 of the Users' Manual.
PASS WORD
View or change password code in SPA memory*.
Refer to Figure 23, page 31 of the Users' Manual.
*If Password Jumper is installed in ON position, valid password is required to view or make changes to password code here.
CONF EXIT
Exit configuration menus and return to real-time display of selected process variable.

*To access Second through Fourth Variables, you must properly configure the NUM VARS submenu of the SET HART menu.

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Introduction

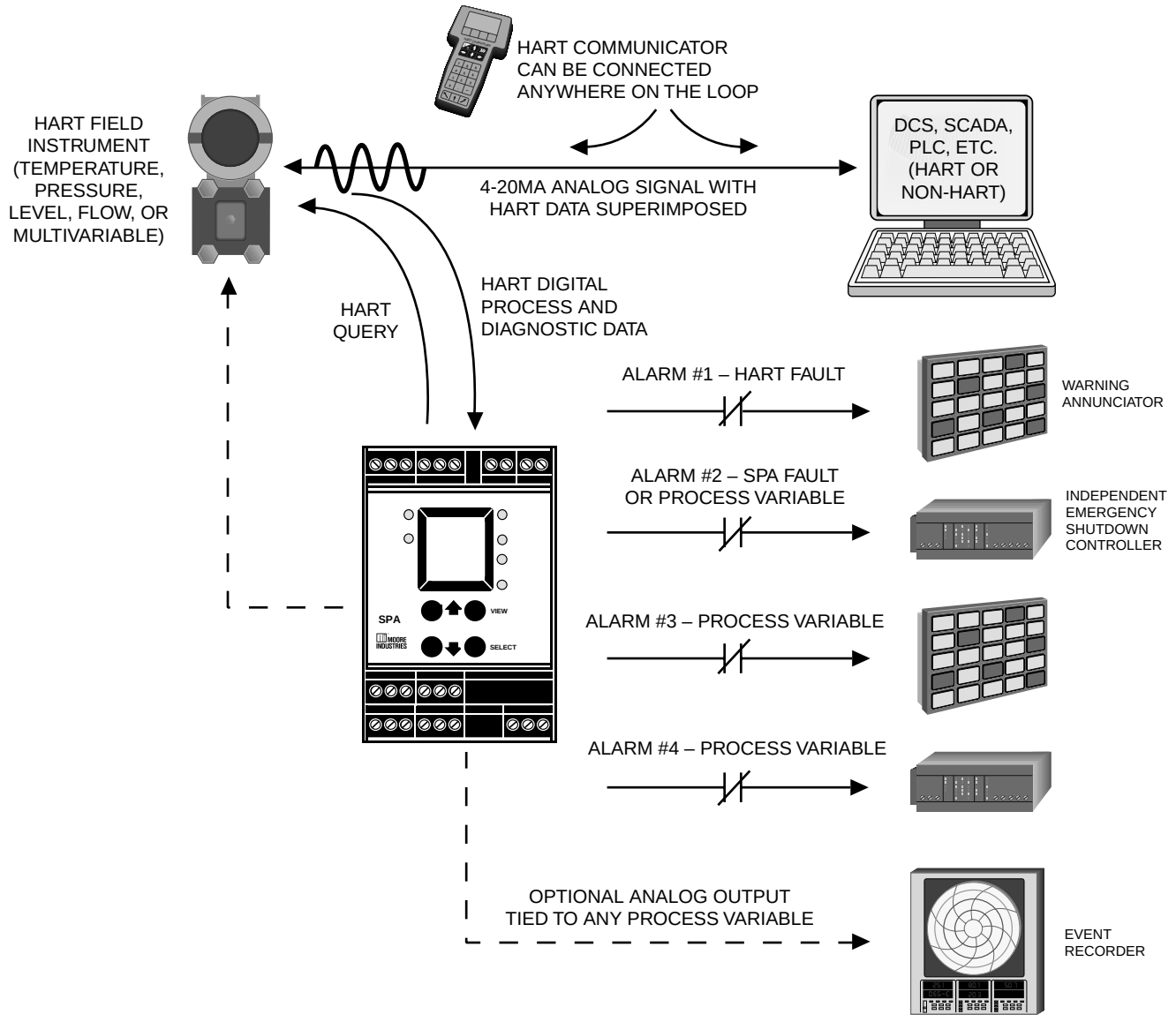
This is the user's manual for the Moore Industries' SPA HART Loop Monitor and Alarm. The SPA HART is a device that monitors a process input from a smart HART device and provides up to four contact closure outputs whenever the input falls outside a user-set high or low trip point. SPAs are typically used to activate a warning light, bell, or buzzer; or to initiate a system shutdown, thus acting as a simple, highly reliable means of safeguarding your process.

About this Booklet

Wherever you see a "*Note*", "***Caution***", or "***WARNING***" pay particular attention.

- A "*Note*" provides information to help you in avoiding minor inconveniences during calibration, installation, or operation of the SPA.
- A "***Caution***" provides information on steps to take in avoiding procedures and practices that could risk damage to the SPA or other equipment.
- A "***WARNING***" provides information on steps to take in avoiding procedures and practices that could pose safety risks to personnel.

Figure 1. *An Overview of the SPA with HART*



SPA WITH HART

The SPA HART

The SPA with HART is a 4-wire (line or mains powered), site-programmable, digital process alarm. It connects to a standard HART field device, and provides up to four, fully-configurable, contact-closure outputs and one analog output based on "readings" of the HART digital data. See Figure 1 for details.

The SPA can be user-set as either the Primary or Secondary HART Master in the process loop. It can provide transmitter excitation for the HART transmitter it is monitoring; provide an auxiliary analog output based on the HART-encoded digital input from the Smart device; and can be used as an "on-site" indicator of trouble by virtue of it's programmable LCD and front panel multi-color LEDs.

Inputs

The SPA with HART reads and can display:

- The Primary, Second, Third (tertiary), and Fourth (quartic), HART Variable
- The Current (0-20mA) of the Primary HART Variable

  and

- The scaling (zero and span) of the Primary Variable

Additionally, the SPA with HART monitors its own "health". It constantly checks to make sure that internal programming is correct, and that it is receiving the correct HART signal from the transmitter.

Outputs

The SPA with HART can be ordered with either 2 or 4 alarm outputs.

In both the 2- and 4-alarm configuration, Alarm #1 is a contact closure output that "trips" whenever there is a problem with HART communications. (More on this in the section of this manual that explains the SPA's monitoring of the HART Status Byte information, pages 17 and 18.)

Alarm #2 can be user set to trip either when the SPA itself is malfunctioning (Refer to "SPA Setup—Relay #2, page 13), when any one of the HART variables varies outside a user-defined range, or if the Primary Variable current (PVC) is too high or too low.

Alarms #3 and #4 of the 4-alarm SPA variant, are process variable alarms that are configured by the user to trip when any one of the HART variables varies outside a user-defined range, or if the Primary Variable current (PVC) is too high or too low.

Each of the SPA alarms can be configured for high, low, failsafe, non-failsafe, latching, or non-latching function. Each can also be programmed with a delay and a deadband.

Analog Output Option

The SPA also provides an isolated, scalable 0-20mA or 0-10V output proportional to the monitored process variable.

Custom, 22-Point Linearization

The SPA input can be programmed from the front panel keypad with up to 22 custom linearization points for linearizing its display and/or its optional analog output.

The SPA with HART is a DIGITAL Alarm

The SPA with HART bases all alarm functioning on its reading of the ***digital*** data received from the Smart device. Even its display (and its analog output, when equipped with its –AO option) is based on the digital information it processes.

Additional HART Information

For more information on HART protocol, we recommend referring to any of the documents available from:

The HART Communications Foundation
9390 Research Boulevard, Suite I-350
Austin, Texas 78759-6540 U.S.A.
Telephone: (512) 794-0369
www.hartcomm.org

Specifications

Performance	**Input Accuracy:** Limited by the accuracy of the HART field instrument **Display Accuracy:** ±1 digit **Deadband:** Full display range available; equal to maximum input range in user-set engineering units **Digital Response Time:** Defined by HART protocol as 500 milliseconds (msec), normal mode, 333 msec in burst mode **Alarm Response Time:** Digital response time + 150 msec, max. (Defined as time from the field instrument's reporting a fault until the SPA alarm is tripped) **Alarm Trip Delay:** Programmable from 0-120 seconds **Line Voltage Effect:** ±0.005% of output span for a 1% change in line voltage (ac or dc) **Isolation:** 1000Vrms between case, input, output (units with -AO option) and power terminals **Power Consumption:** 2-4W, nominal; 6W, maximum **Input Over-Range Protection:** ±5Vdc
Analog Output (-AO Option) Performance	**WITH ANALOG OUTPUT** **Output Accuracy:** ±0.03% of output span (includes the combined effects of linearity, hysteresis, repeatability, and adjustment resolution) **Output Stability:** ±0.1% of calibrated span, maximum, over 6 months **Output Response Time:** 500 milliseconds, max. **Ripple (up to 120Hz):** Current output, 10mV peak-to-peak max. when measured across a 250Ω resistor; Voltage output, 50mV peak-to-peak max. **Output Limiting:** 117% of span max., 115% of span typical **Load Effect:** ±0.01% of span from 0 to maximum load resistance on current output
Ambient Conditions	**Operating Range:** –25°C to +65°C (–13°F to +149°F) **Storage Range:** –40°C to +80°C (–40°F to +176°F) **Ambient Temperature Effect:** ±0.005% of output span per °C max. **Relative Humidity:** 0-95% non-condensing **RFI/EMI Protection:** 30V/m - ABC ≤ 0.5% error in reading when tested according to SAMA standard PMC 33.1; 20V/m when tested according to IEC1000-4-3-1995
Adjustments	Front panel push buttons control settings for zero, span, alarm trip points, HART parameters etc.; Easy access internal settings select current (source or sink) or voltage output, failsafe/non-failsafe, and high/low alarm functions; Internal jumper and menu pass-word protect parameter settings
Indicators	**LCD:** 2x4 character, backlit, alphanumeric readout accurate to the nearest digit. **Range:** –9999 to 9999; Auto decimal positioning, or programmable to one or two places **LEDs:** Dual-color TRIP light (one for each relay) shows green for non-alarm, red for alarm; READY light indicates normal operation, extinguishes in the event of any internal failure; Dual-color INPUT light shows green for input with valid HART communica-tions, red for communica-tions failure; Dual-color TRIP1 light shows green for HART in non-alarm, red for HART failure.
Weight	456 to 513 g (16.1 to 18.1 oz)

Specifications subject to change without notice

SPA with HART Factory Defaults

If you have placed or are going to place an order for an SPA with HART without specifying any particular model number, the unit you receive will be shipped with the following "default" parameters:

- Alarm #2 functions as a Process Variable Alarm trip (as opposed to a SPA "Health" alarm)
- The unit functions as a HART Primary Master
- The unit functions in Normal Mode (as opposed to Burst Mode)
- The unit executes 3 retries in attempting to establish communications with the connected HART device, before returning a HART Fault
- The unit distinguishes the start of a polling message with 5 preambles
- The unit's Alarm #1 trips on any HART Fault bit
- Input scaling is 0-100%
- Input Linearization is OFF

All of these parameters can be changed by the user with the instructions in this manual.

SPA WITH HART

Ordering Information

Unit	Input	Output	Power	Options	Housing
SPA Site-Programmable Alarm	**HART** Accepts a HART digital protocol input directly from a HART temperature, pressure, level, flow, valve positioner, or multivariable transmitter (HART version 5.4 and earlier)	**2PRG** Dual Relays RELAY #1 is a HART instrument fault alarm RELAY #2 configures as either a SPA instrument fault alarm or as a process variable alarm **4PRG** Quad Relays RELAY #1 is a HART instrument fault alarm RELAY #2 configures as either a SPA instrument fault alarm or as a process variable alarm RELAY #3 is a process variable alarm RELAY #4 is a process variable alarm Process variable alarm relays configure independently for: High or Low Trip Normally Open or Normally Closed Failsafe or Non-Failsafe Latching or Non-Latching Trip Delay (Relays are single-pole/double-throw (SPDT), 1 form C, rated 5A @ 250Vac or 24Vdc, 50/60Hz, non-inductive)	**U** Universal, 4-wire (line) power; accepts any power input range between 22-300Vdc or 90-260Vac For CE approved units, specify one of the following: **24DC** ±10% **117AC** ±10% **230AC** ±10%	**-AO** Analog output scaleable for any range between 0-20mA (4mA span, min.) into 1200Ω or 0-10V (1V span, min.) into 10KΩ **-DPDT** Double-pole/double-throw relays, 2 form C relays, rated 5A @ 250Vac, 50/60Hz, non-inductive (2PRG output types only) **-HS** Hermetically sealed relays, rated 0.5A @ 117Vac and 2A @ 28Vdc	**DIN** Universal DIN-style housing mounts on 32mm (EN50035) G-type and 35mm (EN50022) Top Hat DIN-rails

When ordering, specify: Unit / Input / Output / Power / Options [Housing]
Model number example: SPA / HART / 4PRG / U / -AO [DIN]

SPA Options

The following list gives details for the options shown in the Ordering Information table. For information on the availability of any options not listed here, or for help in equipping the SPA with the options best suited for your application, call the factory, or your local Interface Solutions professional.

–AO Analog Output - When equipped with this option, the SPA with HART provides an isolated analog output proportional to its processing of its digital, HART input. Settings for the SPA analog output include:

- Current (0-20mA) or Voltage (0-10V); Also programmable for narrower spans
- Source or Sink (Current)
- Reflect Primary, Secondary, Tertiary, or Quartic, HART Variable, or Current of Primary Variable; Reverse or direct relationship

Configuration

In this manual, the term “configuration” is used to refer to the following, four procedures:

1. Verifying that the unit’s internal jumpers are set to provide Password Security for operational settings
2. Setting the internal DIP switches to provide either failsafe of non-failsafe alarm functioning (and current or voltage output, if the SPA is equipped with its -AO option)
3. Hooking up the SPA in a simple test setup that enables the user to view unit settings in memory, and to make whatever changes may be needed according to the requirements of the intended application
4. Making sure that the SPA “synchs up” properly with a HART transmitter or calibrator, that it reads all the variables of the digital signal correctly, and that it provides the prescribed alarm(s) and/or analog output and display, based on changes on the input

Configuration Equipment

To configure and bench check the SPA with HART, the following items will be needed (note that these materials are not supplied by Moore Industries, but should be readily available in those environments otherwise appropriate for instrument calibration.)

Table 1. *Equipment for Configuring the SPA with HART*

Equipment	Specifications
Power Source	22-300Vdc, ±10%; or 90-260Vac, ±10%
Multimeter	Calibrated, Fluke Model 87 or equivalent, accurate to ±0.025%. It is best to have two of these; one to check for continuity (testing contact-closure), and one to calibrate the SPA analog output when –AO option is installed.
Needle-nosed Pliers	Technicians pliers or tweezers for positioning internal jumpers.
Slave HART Field Device or Field Device Simulator (optional)	THZ or TDZ HART Temperature Transmitter or Model 275 HART Communicator. HART input can be useful in calibrating the SPA, but is not required.
Secondary Power Source (optional)	As required for powering the HART Slave device, if used. Consult the manufacturer’s specifications.

We test all of the instruments we sell on equipment that is checked at least every six months for accuracy. All our test equipment is accurate on the order of 3:1, minimum. Every effort should be made to use the most accurate equipment available to configure your SPA prior to placing it into service.

Caution:
The internal circuitry of the SPA is vulnerable to damage from electrostatic discharge.
Make sure to abide by all static safeguarding (ESD) practices any time the SPA housing is to be opened; especially when making changes to the jumper settings or DIP switches inside the SPA.

Setting Jumpers and DIP Switches

The following SPA with HART functions are governed by the positioning of of the internal jumper and DIP switches:

- **Password** - To “protect” the operational settings of the SPA, make sure the Password Jumper shown in Figure 2 is in the “ON” position. With password protection ON, making changes to the SPA configuration can only take place after entering a two-digit, user-defined code (refer to the Password menu explanation, page 33). With password protection OFF, the user can make changes freely to the SPA settings, including the Password code itself.

- **Failsafe/Non-failsafe** - Set the appropriate DIP switch to FAILSAFE in order to configure it to *de-energize* when in an alarm condition. Non-failsafe alarms *energize* when tripped.

- **Current Source/Sink or Voltage** - If the SPA is equipped with its -AO option, this DIP switch setting determines whether the analog output is current or voltage. If the output is to be current, this switch setting also determines whether the unit sinks or sources that current.

To make changes to, or to view the settings of the SPA DIP switches and/or Password jumper, open the access panel in the bottom of the SPA housing. Figures 2, 3, and 4 show the access panel and locations of the jumpers and switches.

Note:
Jumpers are referred to as “”links” in some countries. “DIP” is dual, in-line positioned switch.

Figure 4 shows the location of the DIP switches for setting the parameters of the SPA analog output. This output is present only in those units equipped with the –AO option.

Figure 2. *Accessing and Setting the SPA Password Jumper*

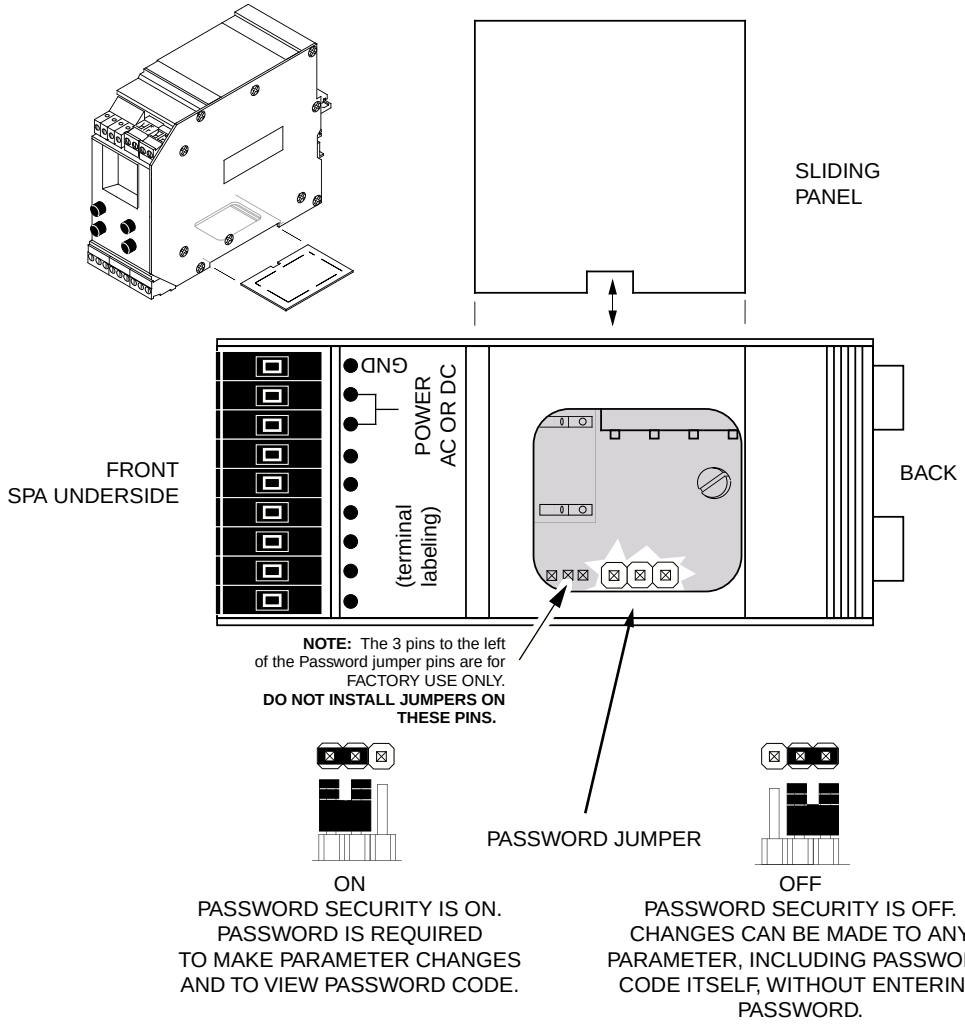
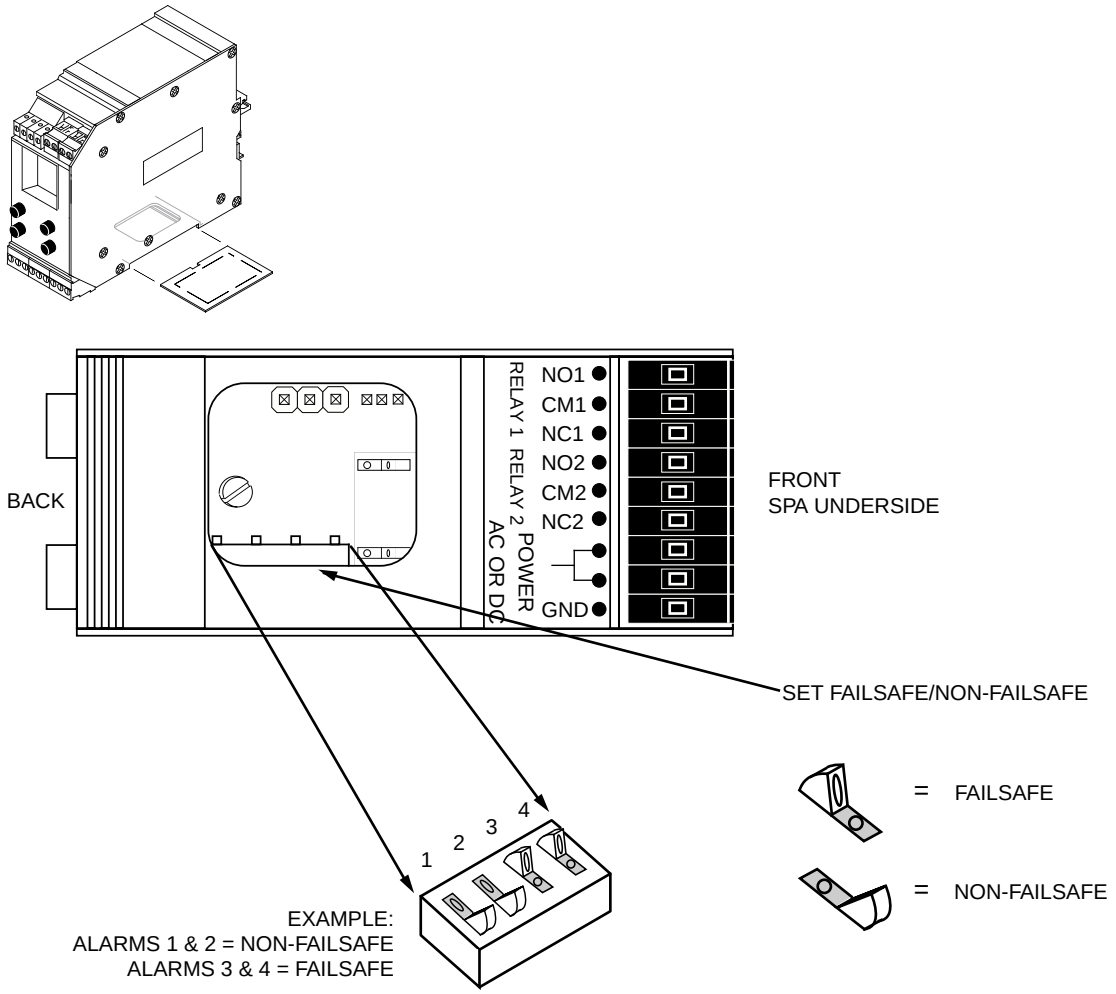
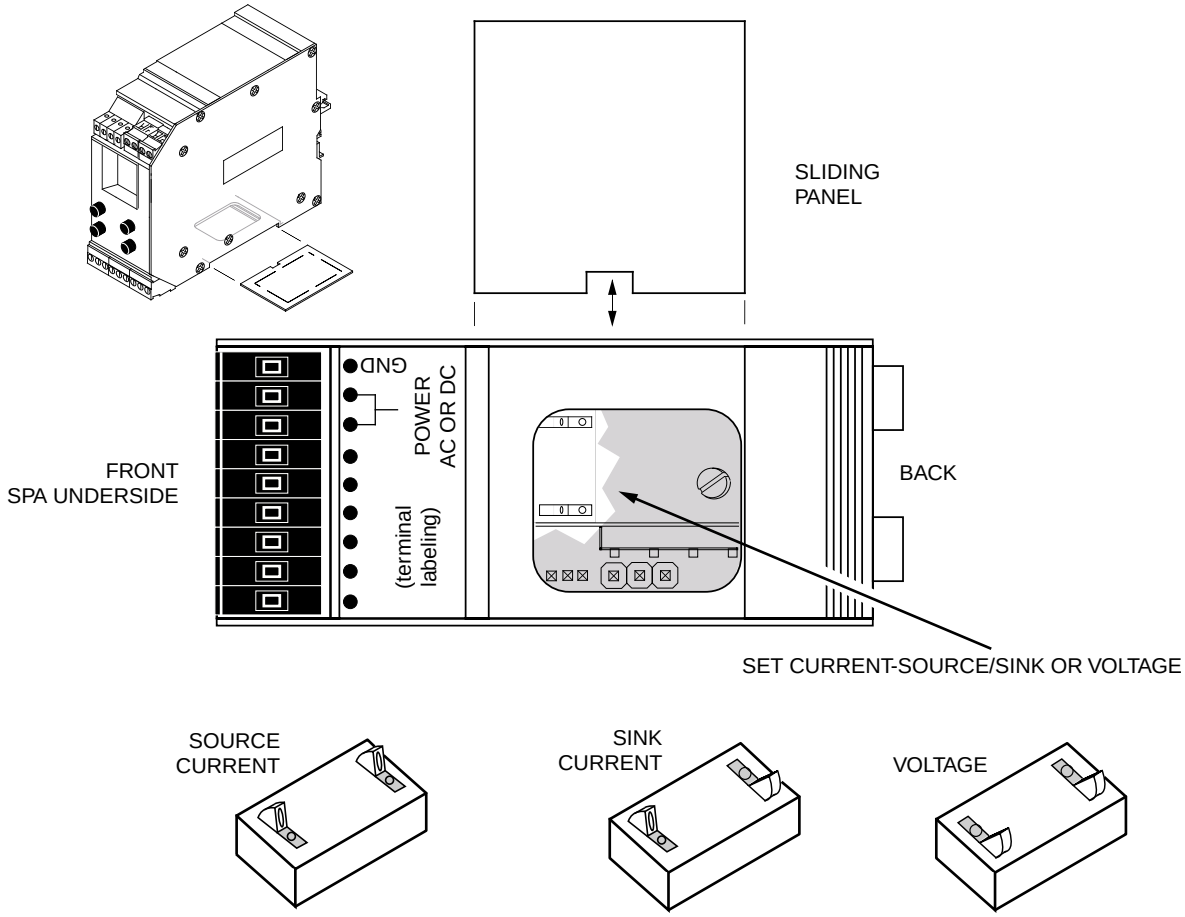


Figure 3. *Accessing and Setting the SPA Failsafe/Non-Failsafe DIP Switches*



NOTE: THIS 4-POSITION SIP SWITCH MAY VARY IN LOCATION BASED ON THE TYPE OF SPA USED

Figure 4. *Accessing and Setting the SPA with HART DIP Switches for Controlling Analog Output (-AO-equipped SPAs only)*



Configuration Setup

After verifying that all the internal jumper and DIP switch settings are correct or otherwise set as needed, use Figure 5 to hook up the SPA with the calibration equipment listed in Table 1 (page 5). To use the SPA's transmitter excitation to power the HART transmitter or simulator in the hookup, refer to Figure 6 for the hookups.

Once hooked up and supplied with the appropriate power, allow a few minutes for stabilization.

Figure 5. *Hooking up the SPA with HART for Calibration*

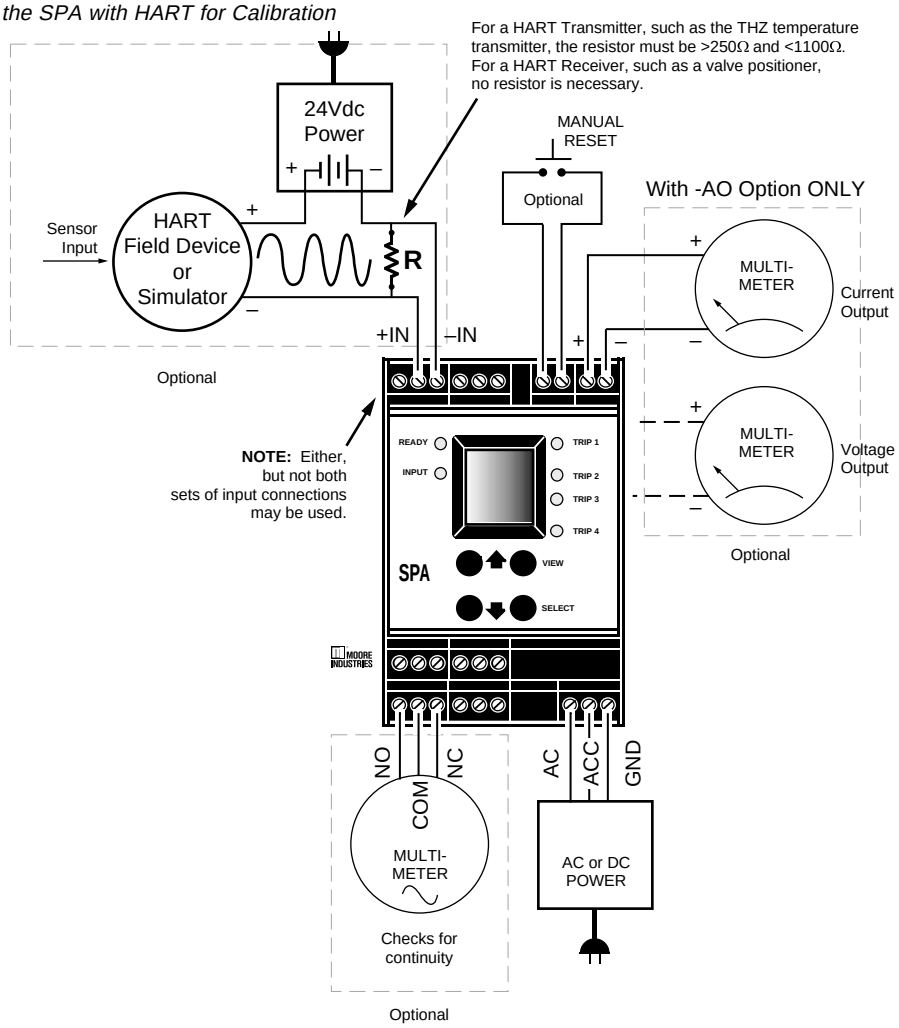
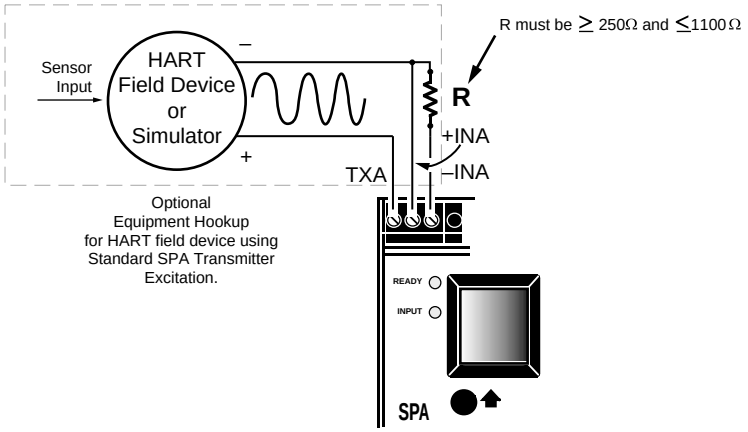


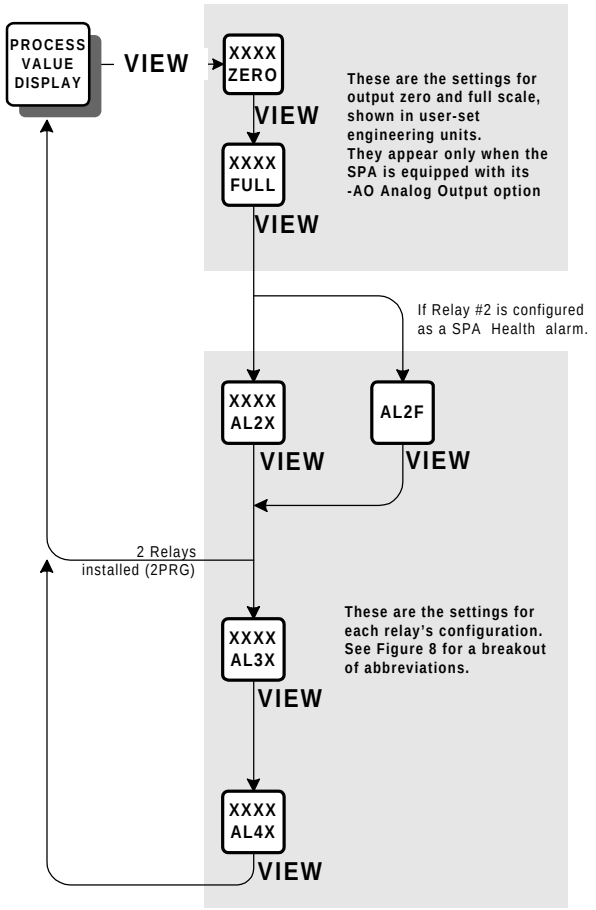
Figure 6. *Hooking up the Transmitter Excitation on the SPA with HART for Calibration*



SPA Setup — Viewing What You Have

With the SPA set up as shown in Figure 5 (or 6), you can run through the View Menu to check the settings already present in unit memory. See Figure 7.

Figure 7. *Viewing the Settings in SPA Memory*

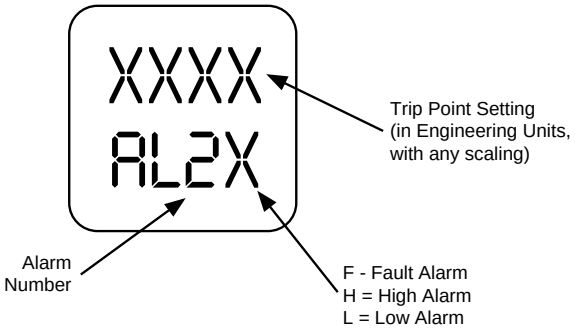

PROCESS VALUE DISPLAY
VIEW
XXXX ZERO
VIEW
XXXX FULL
VIEW
These are the settings for output zero and full scale, shown in user-set engineering units. They appear only when the SPA is equipped with its -AO Analog Output option
If Relay #2 is configured as a SPA Health alarm.
XXXX AL2X
VIEW
AL2F
VIEW
2 Relays installed (2PRG)
XXXX AL3X
VIEW
These are the settings for each relay's configuration. See Figure 8 for a breakout of abbreviations.
XXXX AL4X
VIEW

Notes:
The UP, DOWN, and SELECT push buttons are inactive in the VIEW menu.

No password is needed to view the settings in SPA memory.

Figure 8 gives the breakout for the abbreviations used in the SPA View Menu.

Figure 8. *Understanding the SPA Relays' LCD*



SPA Setup — The Main Configuration Menu

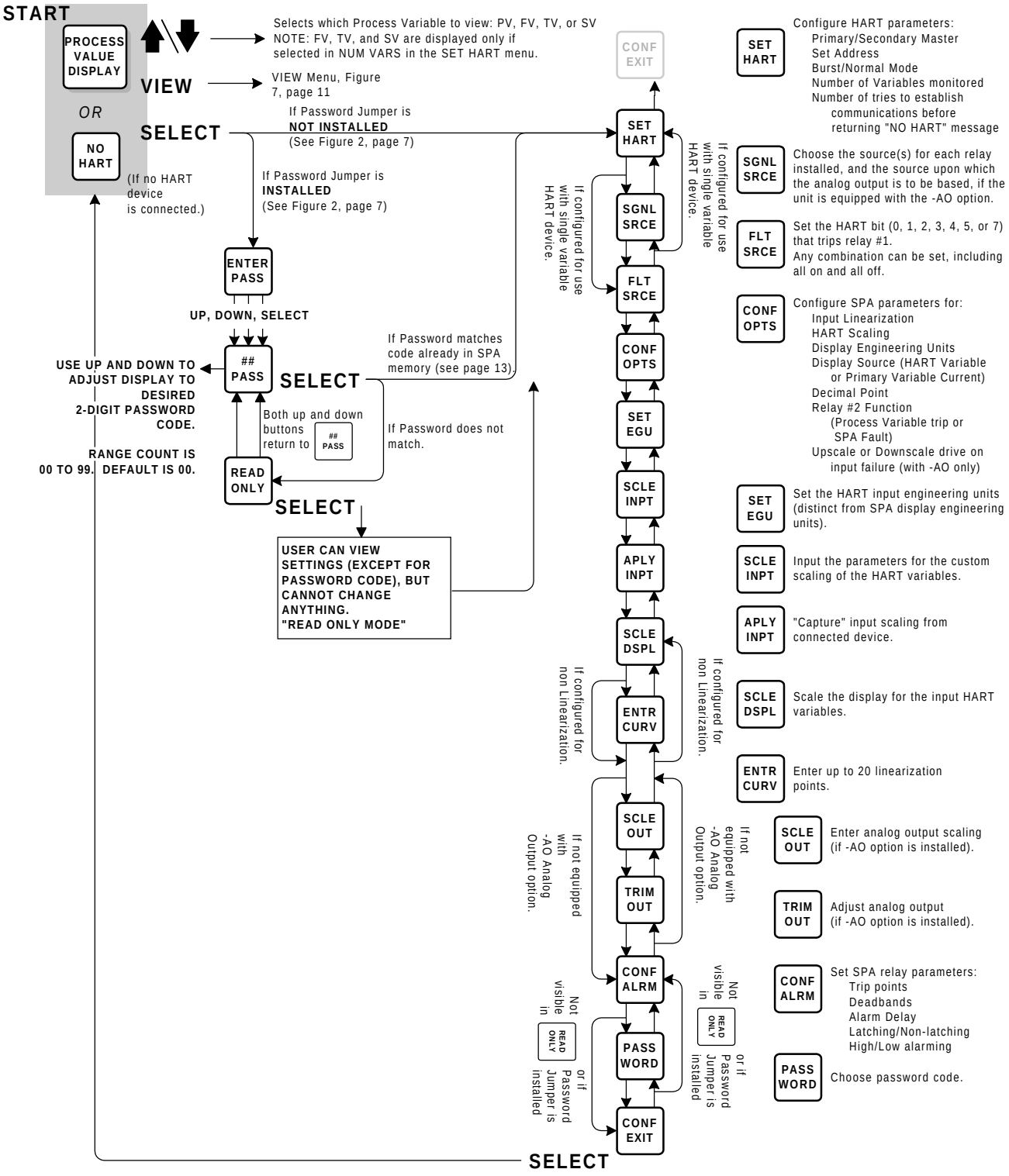
Figure 9 gives an overview of the uppermost level of the SPA menu system. All user-set operating parameters are arranged in hierarchical fashion, stemming from somewhere on this ladder. To enter the sub-menus, scroll through the Main Menu, and press the SELECT button when the display shows the desired sub-menu title.

SPA Setup — Displaying Primary, Second, Third, and Fourth Variables

From the Process Value Display, use the up/down arrow buttons to select which variable you would like the SPA HART to display. You can select from the primary, second, third, and fourth variables.

Note:
The Second, Third, and Fourth Variables are only available if they are selected in the NUM VARS portion of the SET HART menu. (See Figure 10, page 14)

Figure 9. *Moving Around in the SPA Main Configuration Menu*


START
PROCESS VALUE DISPLAY
OR
NO HART
(If no HART device is connected.)
VIEW
Selects which Process Variable to view: PV, FV, TV, or SV
NOTE: FV, TV, and SV are displayed only if selected in NUM VARS in the SET HART menu.
VIEW Menu, Figure 7, page 11
SELECT
If Password Jumper is NOT INSTALLED (See Figure 2, page 7)
If Password Jumper is INSTALLED (See Figure 2, page 7)
ENTER PASS
UP, DOWN, SELECT
PASS
USE UP AND DOWN TO ADJUST DISPLAY TO DESIRED 2-DIGIT PASSWORD CODE.
RANGE COUNT IS 00 TO 99. DEFAULT IS 00.
SELECT
If Password matches code already in SPA memory (see page 13).
Both up and down buttons return to ## PASS
If Password does not match.
READ ONLY
SELECT
USER CAN VIEW SETTINGS (EXCEPT FOR PASSWORD CODE), BUT CANNOT CHANGE ANYTHING. "READ ONLY MODE"
CONF EXIT
SET HART
SGNL SRCE
FLT SRCE
CONF OPTS
SET EGU
SCLE INPT
APLY INPT
SCLE DSPL
ENTR CURV
SCLE OUT
TRIM OUT
CONF ALRM
PASS WORD
CONF EXIT
If configured for use with single variable HART device.
If configured for non Linearization.
If not equipped with -AO Analog Output option.
Not visible in READ ONLY or if Password Jumper is installed
SELECT
Configure HART parameters:
Primary/Secondary Master
Set Address
Burst/Normal Mode
Number of Variables monitored
Number of tries to establish communications before returning "NO HART" message
Choose the source(s) for each relay installed, and the source upon which the analog output is to be based, if the unit is equipped with the -AO option.
Set the HART bit (0, 1, 2, 3, 4, 5, or 7) that trips relay #1.
Any combination can be set, including all on and all off.
Configure SPA parameters for:
Input Linearization
HART Scaling
Display Engineering Units
Display Source (HART Variable or Primary Variable Current)
Decimal Point
Relay #2 Function (Process Variable trip or SPA Fault)
Upscale or Downscale drive on input failure (with -AO only)
Set the HART input engineering units (distinct from SPA display engineering units).
Input the parameters for the custom scaling of the HART variables.
"Capture" input scaling from connected device.
Scale the display for the input HART variables.
Enter up to 20 linearization points.
Enter analog output scaling (if -AO option is installed).
Adjust analog output (if -AO option is installed).
Set SPA relay parameters:
Trip points
Deadbands
Alarm Delay
Latching/Non-latching
High/Low alarming
Choose password code.

SPA Setup — Relay #1

Relay #1 on the SPA with HART is factory-set to "trip" whenever the unit detects a fault in the connected HART device. The relay provides a contact-closure output based on the status of the HART device, monitoring the HART "Status Byte" several times a second.

Note:
The function of Relay #1 on the SPA with HART cannot be changed.
The user can, however, set several operating parameters that affect its function.
See Figure 10, page 14.

SPA Setup — Relay #2

Relay #2 on the SPA with HART can be user-configured to trip under one of two conditions. First, it can be configured as a SPA "health" alarm, providing contact-closure output if there is a communications failure, or if the unit detects an error in its own memory or processing.

Alternatively, it can be configured as a standard, digital process variable alarm. This configuration brings the number of available process alarms to 3 in 4PRG output SPA model variants.

The SPA is configured at the factory with its Relay #2 as a Process Variable alarm.

SET HART SPA Setup — HART Configuration

The first thing to set up in the SPA with HART are the parameters that control how the unit "talks" to the HART device it will be monitoring. Accordingly, this is the first sub-menu accessible from the Main Configuration menu (see Figure 9, page 12).

Figure 10 shows the sub-menu for setting the HART parameters.

SET ADDR Set Address

The HART procotol allows for up to fifteen different HART transmitters to be placed on one loop. Use the "Set Address" function to select the address of the HART field device that the SPA is to monitor.

SET MSTR Primary/Secondary Master

The HART protocol is designed to take advantage of a dual-master networking topology. This allows for two communications masters on the loop, a Primary and a Secondary.

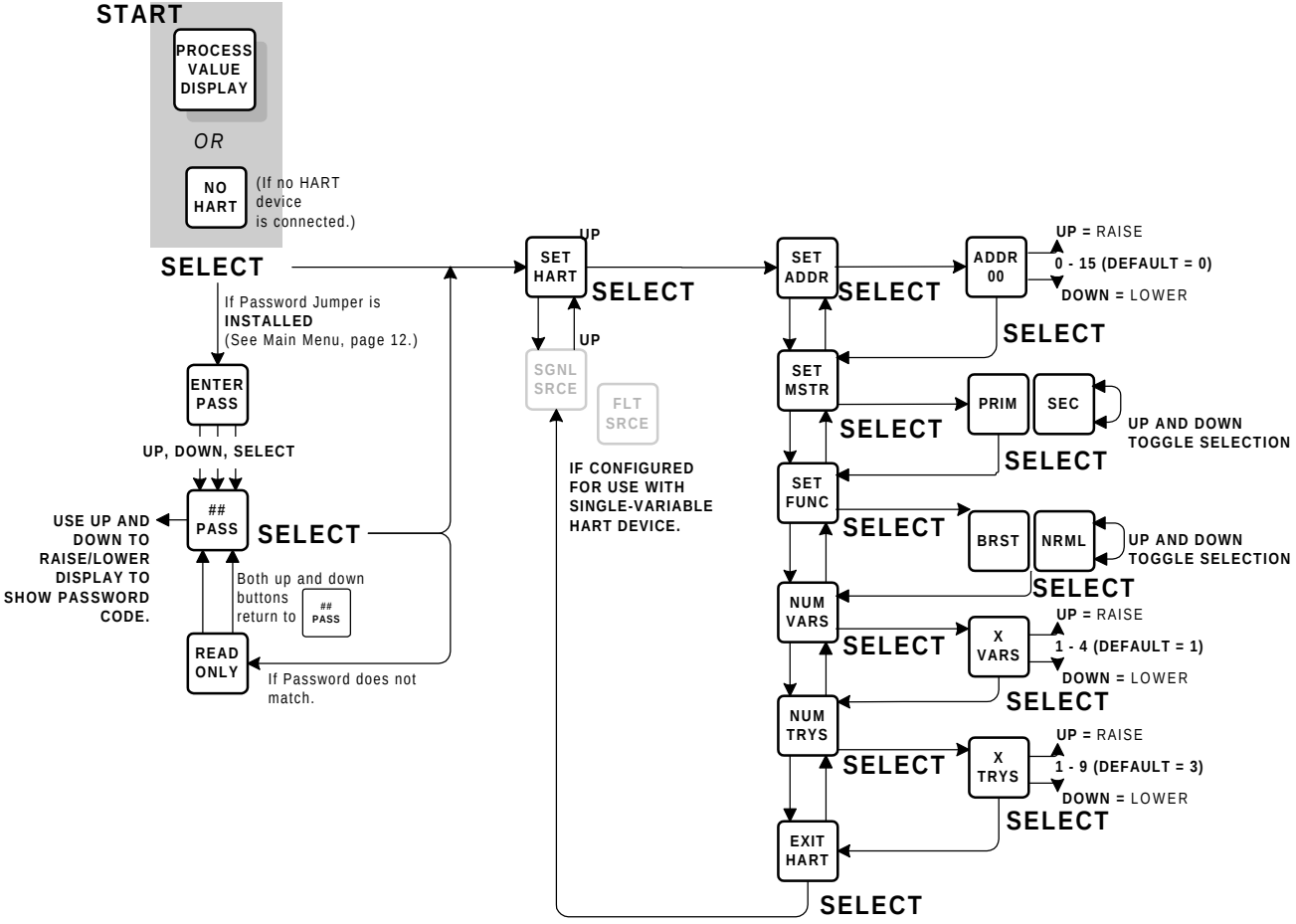
The factory sets the SPA to function as the Primary HART master by default.

Note:
Setting the SPA to function as the Primary HART Master in the application means that any other HART device in the loop ***MUST*** *be configured either as a HART Secondary Master (1 per loop), or as a HART Slave (up to 15 per loop).*

Conversely, setting the SPA to function as the Secondary Master allows other HART devices to function either as a Primary Master (1 per loop), or as Slaves (15 per loop).

Configuring more than one device on a single loop as a Primary or Secondary HART Master will cause a communications failure.

Figure 10. *Configured the HART Alarm Parameters for the SPA*



SET FUNC Normal/Burst Mode

The SPA can be user-configured to operate either in Normal HART mode, or in Burst HART mode.

In Normal mode, once communications have been established with a HART device, the SPA queries that device twice per second, acting according to its setting either as the Primary or Secondary HART Master.

In Burst mode, once communications between the SPA and the connected field device have been established, the SPA continuously "listens" for incoming data from the field device without ever issuing a query. In this mode, the SPA reads incoming data 3 times per second.

The factory default is Normal mode.

NUM VARS Number of Variables

The SPA is capable of monitoring the first 4 digital process variables from the connected HART device.

Factory default is 1; the Primary HART variable only.

Note:
The setting for Number of Variables has an affect on the number of selections available in the Signal Source menu. Choices in that menu for Secondary, Tertiary, and Fourth (Quartic) variables as sources for SPA Alarms (and analog output) are shown only if the Number of Variables selection in the Set HART menu is 2, 3, or 4, respectively.

NUM TRYS Number of TRYS (Tries)

This setting allows the user to configure the SPA to "poll" the communications bus, attempting to connect to a field device from 1 to 9 times before returning the "NO HART" message on the SPA, and issuing an alarm from Relay #2 (if configured as a SPA "health" alarm).

The factory default for the Number of Tries is 3.

SGNL SRCE SPA Setup — Alarm Source

This is the sub-menu with which Alarms 2 (if configured as a Process Variable Alarm, refer to page 13), 3, and 4 are assigned those aspects of the HART input data upon which to base their functioning. Additionally, if the SPA is equipped with its -AO Analog Output option, this sub-menu sets the HART variable upon which it will be based.

This menu is only accessible on those SPAs that are to process more than one HART variable. It is also only accessible on SPAs with more than 2 relays (4PRG output model variant).

Figure 11 shows the sub-menu for configuring the Signal Source for each SPA input and output available.

AOUT SRCE Analog Output Source

This is the setting that determines which of the available HART parameters the SPA will base its analog output upon.

If the -AO Analog Output option is not installed, this section of the sub-menu is skipped, and the first selection will be for AL2 or AL3.

Note:
The selection for Primary Variable Current is available only when configuring the signal source for the analog output, and is only shown when the SPA –AO option is present.

AL2 SRCE AL3 SRCE AL4 SRCE Relay Sources

These menus permit the user to configure the available SPA relays to respond to changes in any combination of the first 4 variables of the HART input.

"PV" signifies the Primary HART variable, "SV" the secondary variable, "TV" the third or tertiary variable, and "FV" the fourth or quartic variable.

Note:
The selections for Secondary, Tertiary, and Fourth (Quartic) variables as signal sources appear only if the Number of Variables selection in the Set HART menu is 2, 3, or 4, respectively (see Figure 10, page 14).

Figure 11. *Choosing the Sources for the SPA Relays*

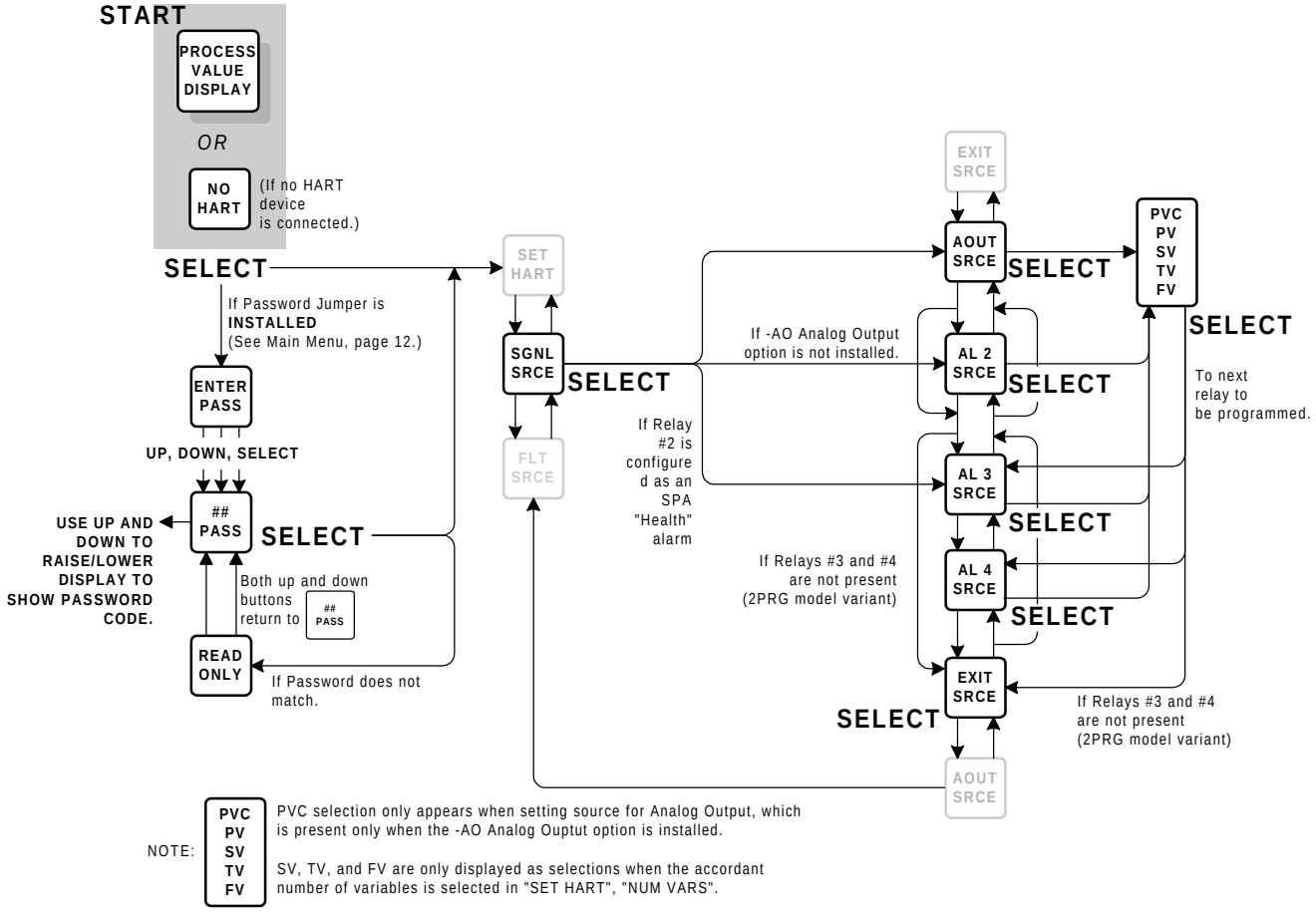
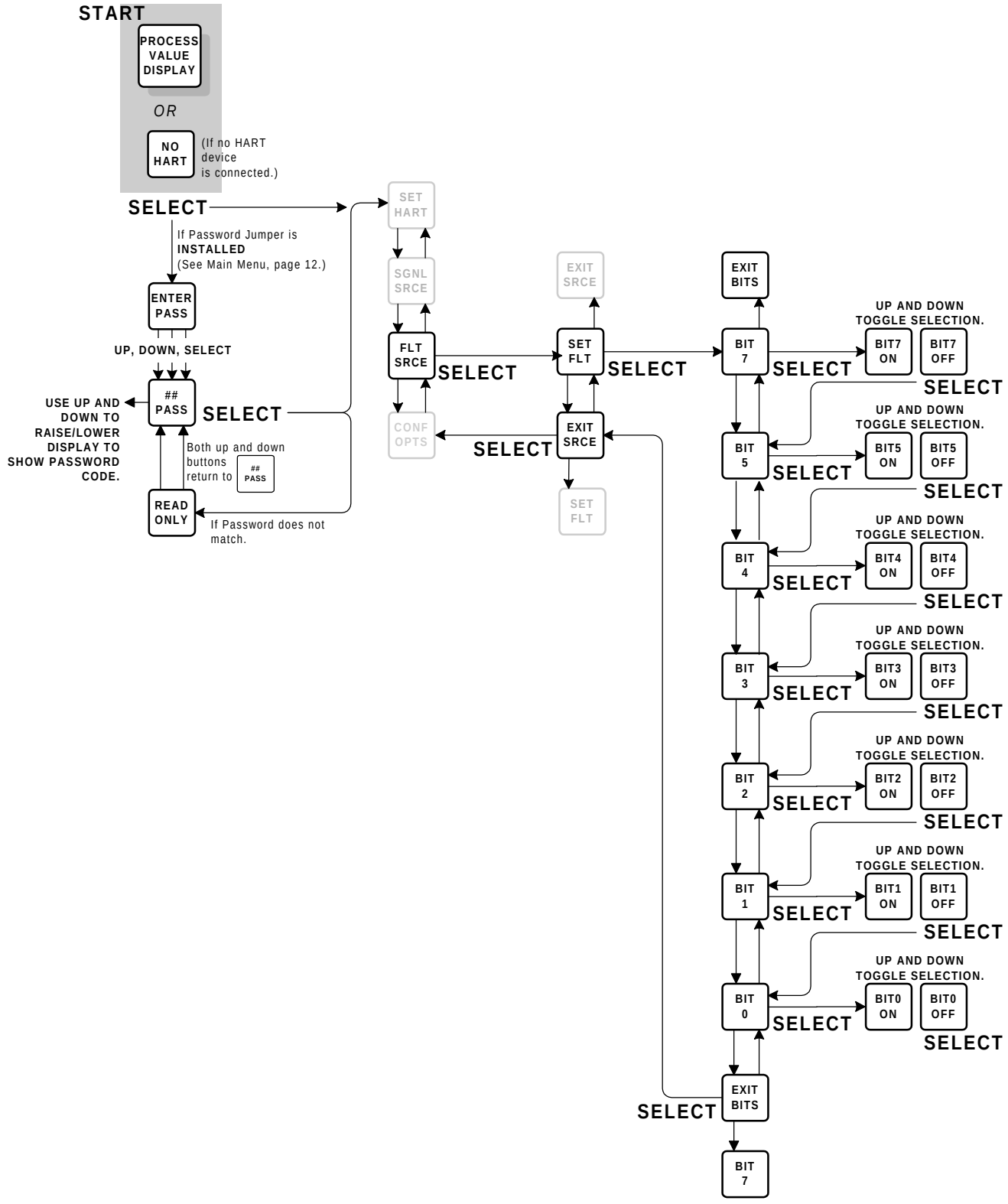

START
PROCESS VALUE DISPLAY
OR
NO HART
(If no HART device is connected.)
SELECT
If Password Jumper is INSTALLED (See Main Menu, page 12.)
ENTER PASS
UP, DOWN, SELECT
PASS
SELECT
USE UP AND DOWN TO RAISE/LOWER DISPLAY TO SHOW PASSWORD CODE.
Both up and down buttons return to ## PASS
READ ONLY
If Password does not match.
SET HART
SGNL SRCE
SELECT
FLT SRCE
If Relay #2 is configured as an SPA "Health" alarm
If -AO Analog Output option is not installed.
EXIT SRCE
AOUT SRCE
SELECT
PVC PV SV TV FV
SELECT
To next relay to be programmed.
AL 2 SRCE
SELECT
AL 3 SRCE
SELECT
If Relays #3 and #4 are not present (2PRG model variant)
AL 4 SRCE
SELECT
EXIT SRCE
SELECT
If Relays #3 and #4 are not present (2PRG model variant)
AOUT SRCE
NOTE:
PVC PV SV TV FV
PVC selection only appears when setting source for Analog Output, which is present only when the -AO Analog Ouptut option is installed.
SV, TV, and FV are only displayed as selections when the accordant number of variables is selected in "SET HART", "NUM VARS".

Figure 12. *Choosing the HART Source for SPA Relay #1*



FLT SRCE SPA Setup — Fault Source

The settings in this sub-menu control the function of the SPA relay #1, the HART monitor. The SPA's first relay, Alarm #1, is permanently dedicated to monitoring the function of the HART device and communications.

The user can choose among 7 HART conditions to produce an alarm. Figure 12 is a map of this sub-menu. Any combination, including all bits or no bits may be set.

BIT 7 Bit 7 — Field Device Malfunction

Set this bit ON to configure the SPA Relay #1 to trip whenever it detects that a hardware error or failure has occurred in the connected HART device.

BIT 5 Bit 5 — Cold Start

Set this bit to ON to configure the SPA Relay #1 to trip whenever power to the HART device is interrupted. If ON, this bit will also trip the alarm following a HART Master Reset or Self Test command.

BIT 4 Bit 4 — More Status Available

Set this bit to ON to configure the SPA Relay #1 to trip whenever the HART device reports a condition requiring HART Command #48, which is "Read Additional Information". That is, if ON, this bit trips the alarm to indicate that the HART device requires attention from a diagnostic tool with full HART command capability.

BIT 3 Bit 3 — Primary Variable Analog Output Fixed

Set this bit to ON to configure the SPA Relay #1 to trip whenever the HART device detects that its Primary Variable (typically the analog output) is no longer responding to changes on its input, and is, in fact being held at a predefined level.

BIT 2 Bit 2 — Primary Variable Analog Output Saturated

Set this bit to ON to configure the SPA Relay #1 to trip whenever the HART device detects that both its analog and digital representations of the Primary Variable are outside rated operating limits, and no longer reflect the true sensor input.

BIT 1 Bit 1 — Non-Primary Variable Out of Limits

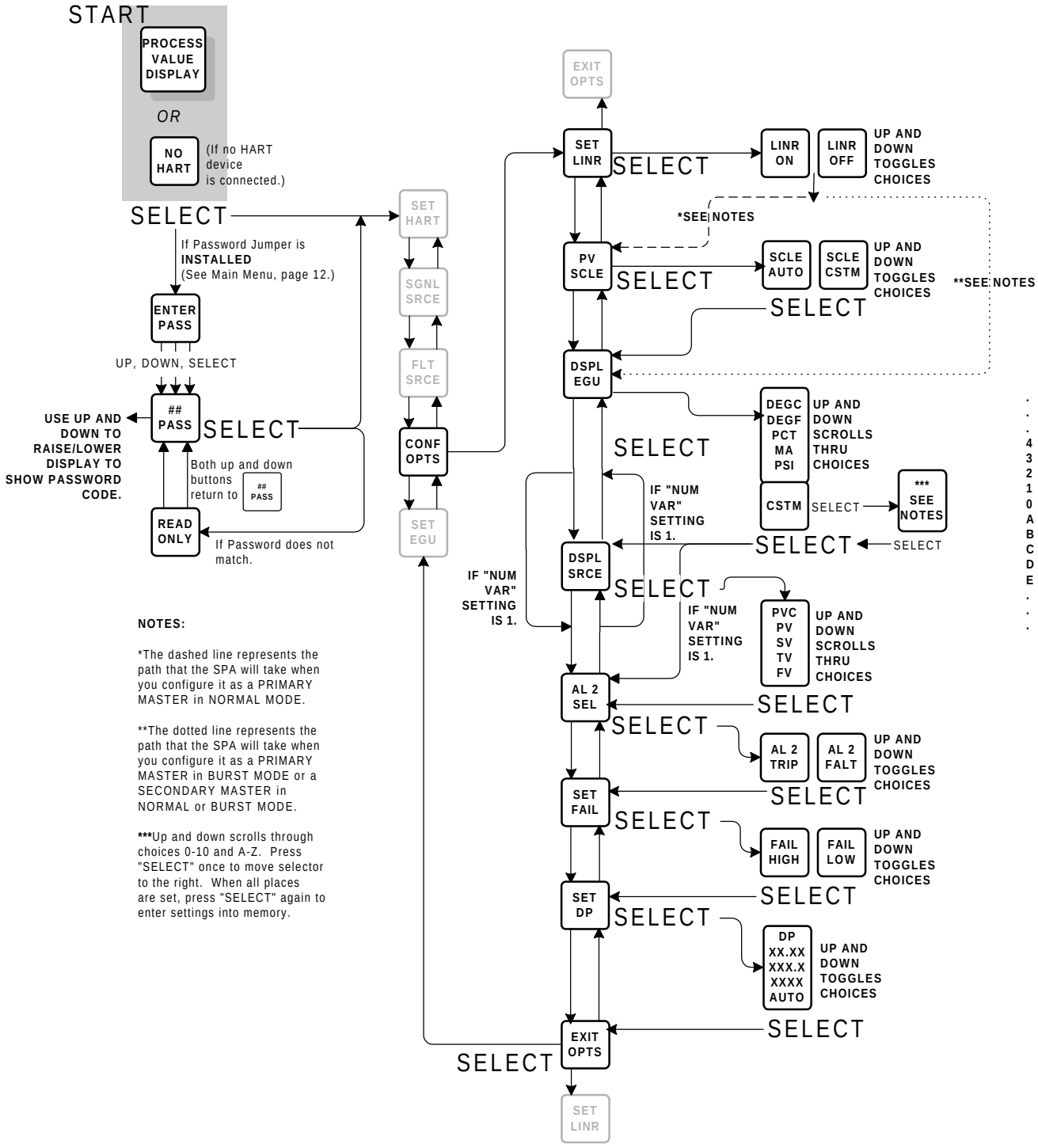
Set this bit to ON to configure the SPA Relay #1 to trip whenever the HART device detects that one of its ancillary variables (pressure, temperature, etc.) is operating outside the limits that can be effectively measured. HART Command #48, "Read Additional Information" may be required to determine which variable is causing the problem.

BIT 0 Bit 0 — Primary Variable Out of Limits

Set this bit to ON to configure the SPA Relay #1 to trip whenever the HART device detects that the measured process value, typically input from some kind of sensor, is beyond its rated limits.

Note:
The Fault Bits can be set in any combination, including all ON and all OFF.

Figure 13. *Configuring Miscellaneous SPA Operating Options*



NOTES:

*The dashed line represents the path that the SPA will take when you configure it as a PRIMARY MASTER in NORMAL MODE.

**The dotted line represents the path that the SPA will take when you configure it as a PRIMARY MASTER in BURST MODE or a SECONDARY MASTER in NORMAL or BURST MODE.

***Up and down scrolls through choices 0-10 and A-Z. Press "SELECT" once to move selector to the right. When all places are set, press "SELECT" again to enter settings into memory.

CONF OPTS SPA Setup — Configuring Miscellaneous Options

This sub-menu comprises the settings for input linearization, Primary HART Variable scaling, engineering units for the SPA display, which HART variable is to be shown on the SPA display, how Relay #2 functions (Process Trip, or SPA malfunction alarm), and how the SPA analog output (if present) behaves in the event of input failure. Figure 13 shows the menu.

SET LINR Toggle Linearization On/Off

This setting determines whether the SPA will linearize the input from the HART device. The SPA is capable of 20-point linearization, with customizable curves. Refer to the Enter Curve sub-menu, explained on page 25.

Note:
If Linearization is set to OFF, the Enter Curve sub-menu (see page 25) is not accessible on the Main Configuration menu (page 12).

PV SCLE Customizing the Primary Variable Scaling

Toggle this setting to “CSTM” (Custom) to enable the SPA’s capability to perform additional offset and span scaling—beyond the scaling features of the HART transmitter itself—on the Primary Variable.

Toggle this setting to “AUTO” (Automatic) to enable the SPA to “capture” the zero and full scale values for the Primary HART variable automatically.

DSPL EGU Setting the SPA Display Engineering Units

This setting determines how SPA will display the selected process variable input. Choices are:

- DEGC - Degrees Centigrade (Celsius)
- DEGF - Degrees Fahrenheit
- PCT - Percent of Span
- MA - Current in Milliamps
- PSI - Pounds per Square Inch
- CSTM - 4-place, alphanumeric user-set display

DSPL SRCE Choosing the Source for the SPA Display

This setting selects which of the available HART Variables will be shown as the Process Value during normal SPA operation.

Note:
The number of selections available in this sub-menu is determined by the “NUM VARS” setting in the SET HART sub-menu.
Refer to Figure 10 on page 14.

AL2 SEL Setting the Function of SPA Relay #2

This is where the user sets whether the SPA Relay #2 functions as a Process Variable Alarm or as a SPA “health” alarm. Choose the “TRIP” selection for Process Variable Alarm functionality, “FLT” for SPA health alarm.

SET FAIL Upscale/Downscale Drive

If the SPA is equipped with its -AO Analog Output option, this setting determines how that output will behave in the event of an input failure. Choose “HIGH” for output to ramp to 20mA on input failure, “LOW” for output to ramp downward to 0mA on input failure.

SET DP Set Decimal Point

This sets the SPA’s display to either automatically display the decimal point in the optimum place (auto), or always display the decimal point in a designated place.

SET EGU SPA Setup — Setting Engineering Units

This sub-menu allows the user to assign engineering units to the display of any of the HART Variables that are input to the SPA.

Figure 14 shows the menu.

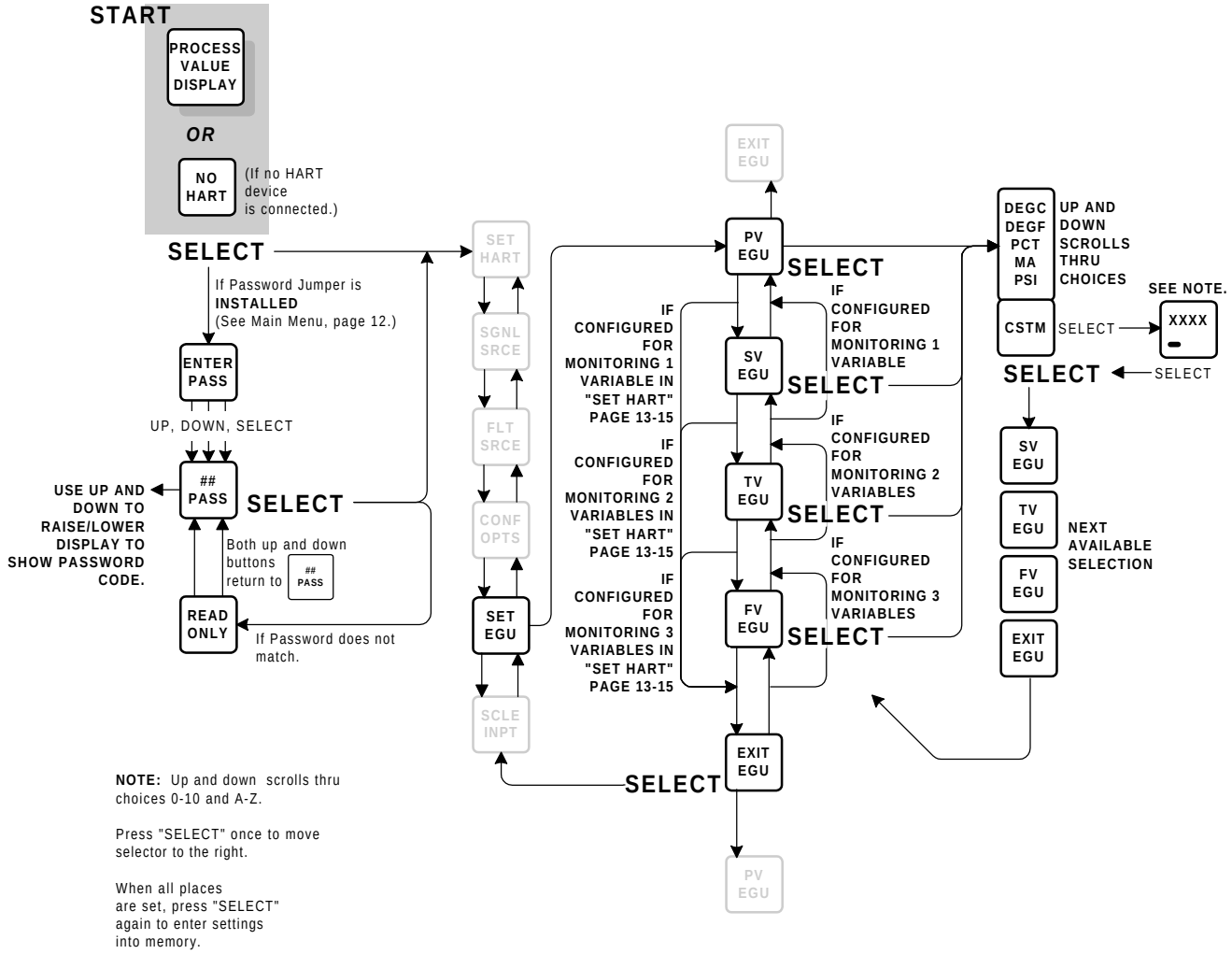
In addition to the standard units for:

- DEGC - Degrees Centigrade (Celsius)
- DEGF - Degrees Fahrenheit
- PCT - Percent of Span
- MA - Current in Milliamps
- PSI - Pounds per Square Inch

If desired, a 4-place, alphanumeric display can also be entered:

- CSTM

Figure 14. *Setting the HART Display Engineering Units*


START
PROCESS VALUE DISPLAY
OR
NO HART
(If no HART device is connected.)
SELECT
If Password Jumper is INSTALLED (See Main Menu, page 12.)
ENTER PASS
UP, DOWN, SELECT
PASS
SELECT
USE UP AND DOWN TO RAISE/LOWER DISPLAY TO SHOW PASSWORD CODE.
Both up and down buttons return to ## PASS
READ ONLY
If Password does not match.
SET HART
SGNL SRCE
FLT SRCE
CONF OPTS
SET EGU
SCLE INPT
EXIT EGU
PV EGU
SELECT
IF CONFIGURED FOR MONITORING 1 VARIABLE
SV EGU
IF CONFIGURED FOR MONITORING 1 VARIABLE IN "SET HART" PAGE 13-15
IF CONFIGURED FOR MONITORING 2 VARIABLES
TV EGU
IF CONFIGURED FOR MONITORING 2 VARIABLES IN "SET HART" PAGE 13-15
IF CONFIGURED FOR MONITORING 3 VARIABLES
FV EGU
IF CONFIGURED FOR MONITORING 3 VARIABLES IN "SET HART" PAGE 13-15
DEGC DEGF PCT MA PSI
UP AND DOWN SCROLLS THRU CHOICES
CSTM
SELECT
XXXX
SEE NOTE.
SELECT
SELECT
SV EGU
TV EGU
FV EGU
EXIT EGU
NEXT AVAILABLE SELECTION
NOTE: Up and down scrolls thru choices 0-10 and A-Z.
Press "SELECT" once to move selector to the right.
When all places are set, press "SELECT" again to enter settings into memory.

SCLE INPT SPA Setup — Smart Scaling the HART Input

The SPA with HART can read the zero and full scale settings for the Primary Variable directly from a connected HART device. Alternatively, the user can enter values into SPA memory for zero and full scale (for all measured variables). This is called "smart" scaling, because the numeric values are entered directly into memory, without having to connect the SPA to HART input (unless reading zero and full scale automatically).

Note:
Refer to Configuring Miscellaneous Options, pages 19-20, to set the SPA to automatically read the Primary Variable Zero and Full Scale settings.

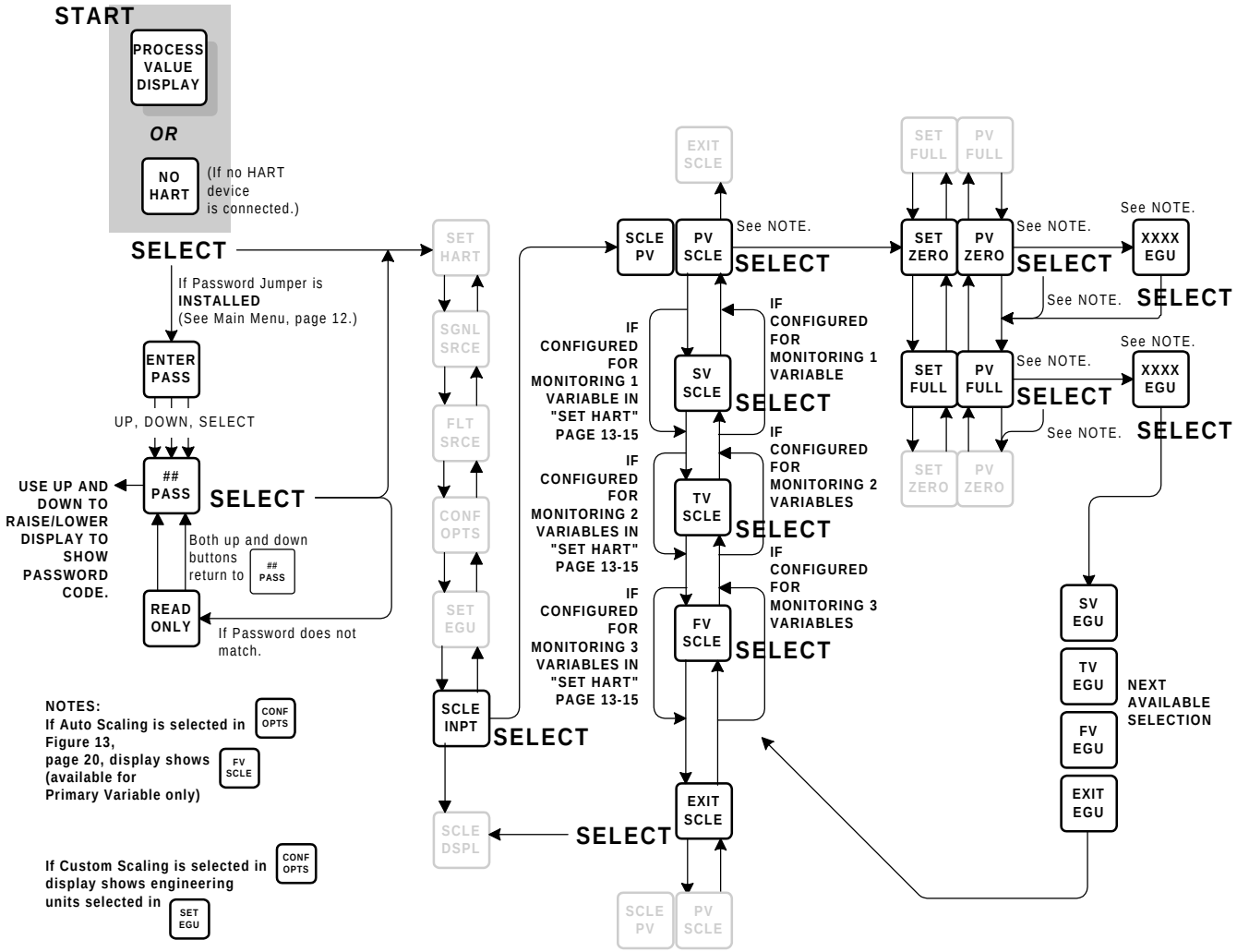
The Smart Scaling sub-menu comprises the settings with which the user can scale the input from the HART device. This scaling is applied to all trip point settings and displays.

Figure 15 shows the menu.

Note that there are two options for setting the scaling of the Primary HART Variable; Auto and Custom. If the SPA is set in the "CONF OPTS" menu (Figure 13, page 19) for Auto Primary Variable scaling, the zero and full scale setting is entered into SPA memory automatically.

If, in the "CONF OPTS" sub-menu, the Primary Variable scaling was set to Custom, the user can, in this sub-menu, use the up and down push buttons to enter custom scaling for the Primary Variable.

Figure 15. *Scaling the HART Variables Input to the SPA*



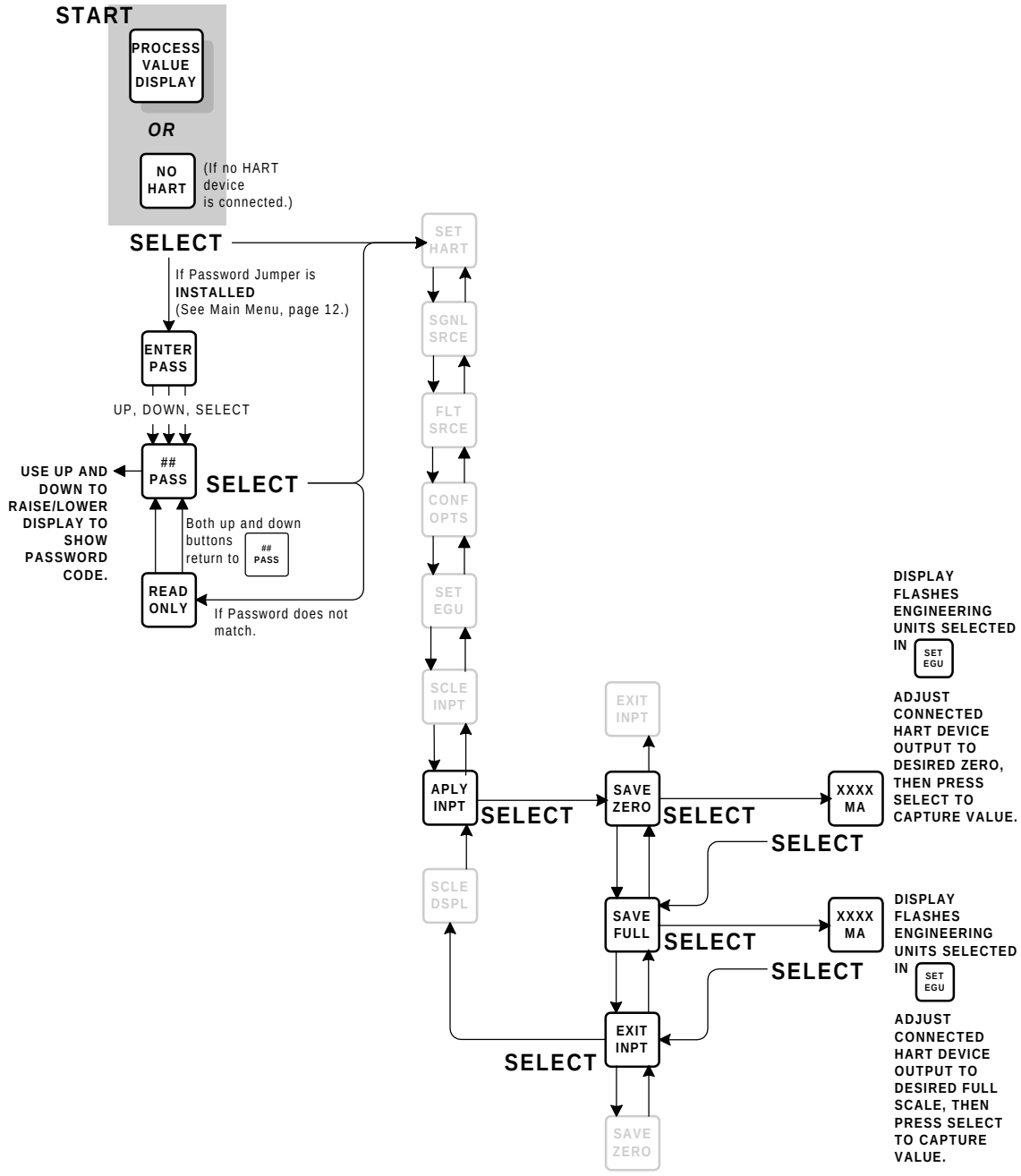
APLY INPT SPA Setup — Bench Scaling HART Input

Note:
Bench Scaling requires that a HART device be connected to the SPA.

This method of scaling the input to the SPA involves "capturing" the actual zero and full scale from a connected HART device. See Figures 5 or 6 on page 10 for help in connecting an instrument to the SPA.

Figure 16 shows the menu, including instructions for when to "apply" the zero and full scale inputs to the calibration setup.

Figure 16. *Bench Scaling the HART Input to the SPA*

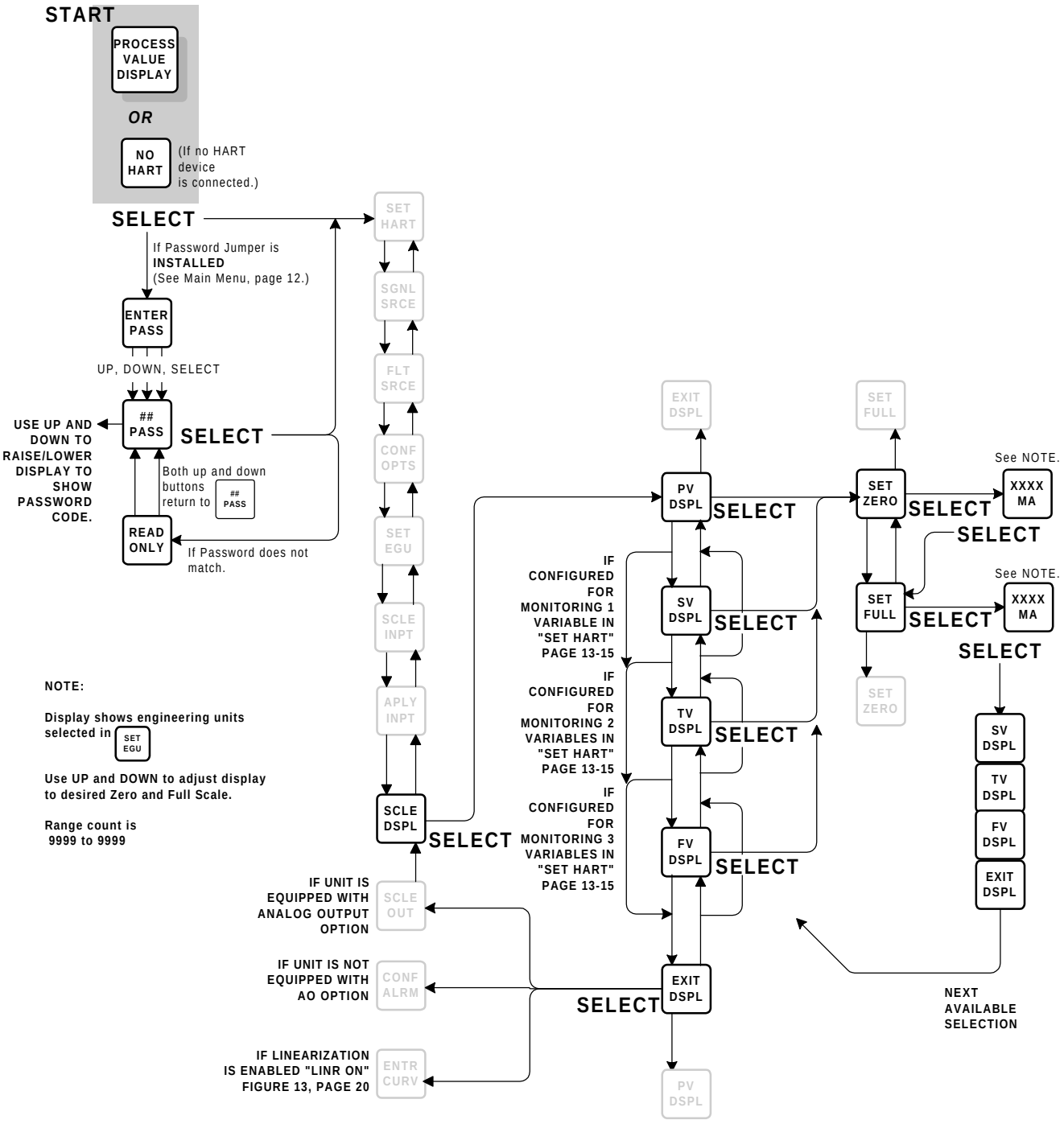


SCLE DSPL SPA Setup — Scaling the HART Input Display

The display of each HART Variable processed by the SPA can be scaled using this sub-menu. See Figure 17.

Note:
The number of selections available in this sub-menu is determined by the "NUM VARS" setting in the SET HART sub-menu.
Refer to Figure 10 on page 14.

Figure 17. *Scaling the SPA Display*

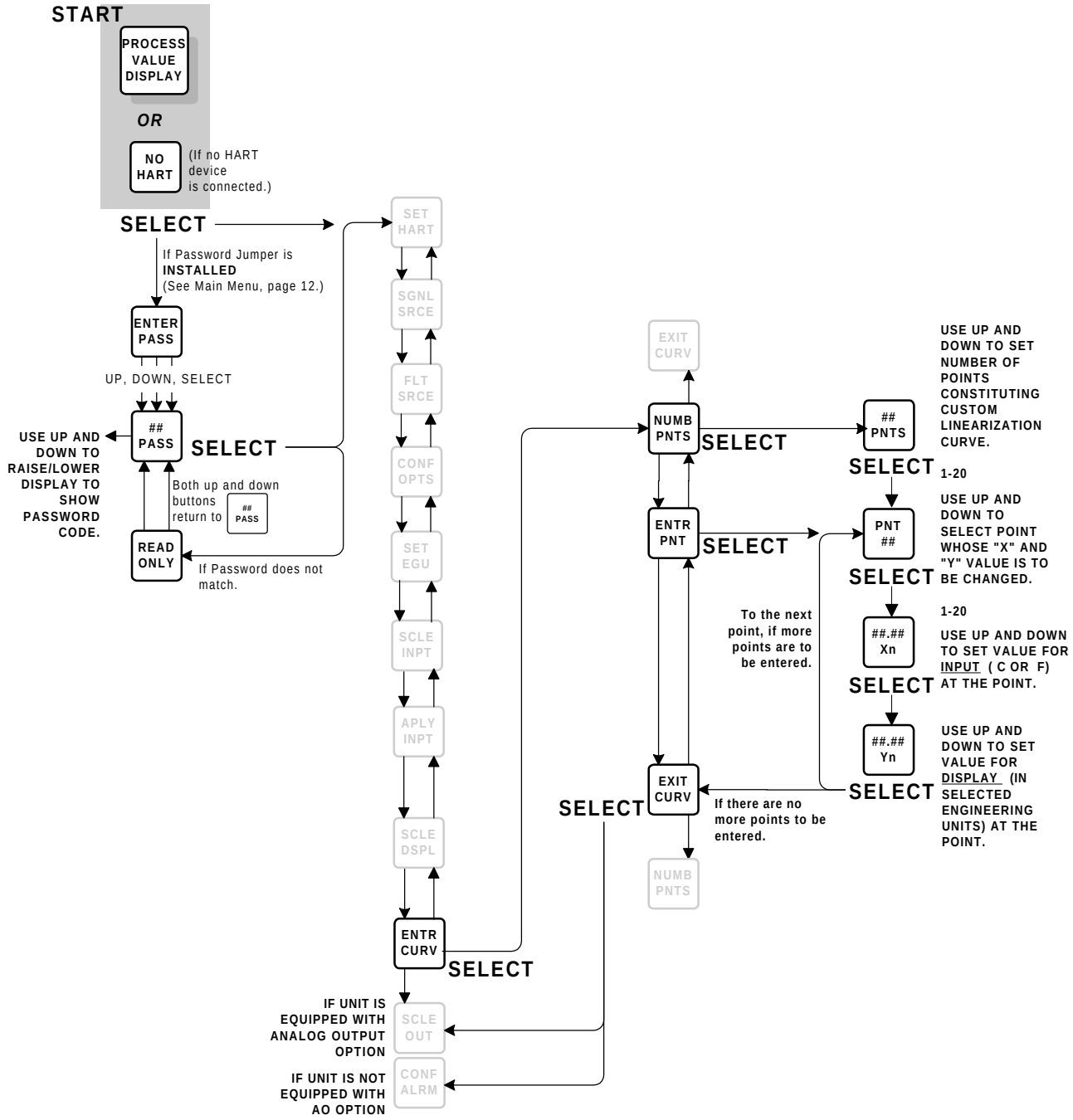


ENTR CURV SPA Setup — Customizing Input Linearization

The SPA can incorporate up to 20 points of linearization in its processing of the HART input. This sub-menu is used to enter those points into memory.

Figure 18 shows the sub-menu.

Figure 18. *Entering Custom Linearization Points for the SPA*



NUMB PNTS Enter the Number of Points to be used to Linearize the Input

The SPA can accommodate up to 20 points to linearize input. The more points entered, the more accurate the SPA display, alarm, and output (with -AO), but the longer it takes to program.

ENTR PNT Go Directly to a Particular Point for Adjustment

If a custom linearization curve is already entered, use this sub-menu to access a particular point and make changes.

XN Set the Value for the INPUT at Point

The display shows the number of the linearization point, and allows the user to set a value, presumably from the connected HART transmitter output, for which a linearization value will be entered.

YN Set the Value for the DISPLAY at Point

The display shows the number of the linearization point, and allows the user to set a SPA value for the input at that point.

RULES:

Where Xz = Input Zero, and
Xf = Input Full Scale, the following *MUST* be true for all entered points:

Xz < Xn < Xn + 1 < Xn + 2 < ... <Xf

AND

Where Yz = Display Zero, and
Yf = Display Full Scale, the following *MUST* be true for all entered points:

Yz < Yn < Yn + 1 < Yn + 2 < ... <Yf

In other words, all the linearizing points entered must fall within a range defined by the zero and full scale settings for both Input and Display.

Applications for Custom Linearization

This SPA capability is quite useful for producing a display and output curve in applications such as providing alarm trips for transmitters monitoring the amount of fluid in a non-cylindrical tank.

Because of the tank's non-linear shape, transmitters monitoring the level of fluid in tanks such as these tend to produce nonlinear output. The SPA can be used to linearize that output and base its alarms and displays on the true level of the fluid in the tank, relative to the percent full or empty.

The SPA linearization function is implemented in a 3-step procedure.

First:

1. The number of points (20, max) that are to constitute the desired linearization curve are determined,

then:

2. The input at each point is specified,

and then finally:

3. The corresponding display value for each point is set.

Note:
Input zero and full scale, as well as display zero and full scale must be programmed prior to programming the linearization curve.

Linearization Example
Here is an example of how to configure the SPA with HART to linearize nonlinear input:

1. Always make sure that zero and full scale have been entered into SPA memory for:

   Input (page 22)

   Display (page 24)

   Output (page 28)

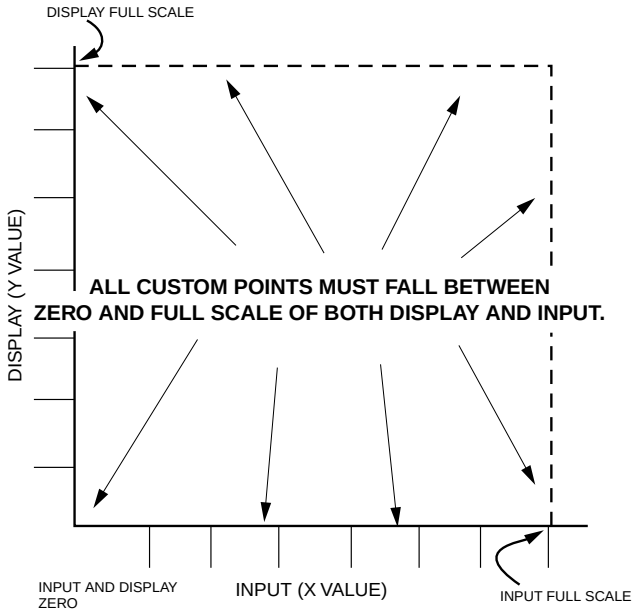
2. Access the "ENTR CURV" sub-menu (see Figure 18, page 25).
3. Refer to Figure 19 to determine:

   The number of points needed to express the desired, custom curve (NUMB PNTS)

   The value at each point for the X axis (input)

   The value at each point for the Y axis (display)

Figure 19. *Plotting Custom Linearization Points for the SPA*


DISPLAY FULL SCALE
DISPLAY (Y VALUE)
ALL CUSTOM POINTS MUST FALL BETWEEN
ZERO AND FULL SCALE OF BOTH DISPLAY AND INPUT.
INPUT AND DISPLAY ZERO
INPUT (X VALUE)
INPUT FULL SCALE

Notes:
When entering the linearization points, the LCD will begin flashing if an attempt is made to enter an "illegal" point (i.e., one that doesn't follow the RULES as outlined).

Also, it is not possible to exit the Linearization Configuring sub-menu until all linearizing points are entered. That is, if 6 points are entered in "NUMB PNTS", it will not be possible to exit from "ENTR CURV" or otherwise return to the Main Menu until values for all 6 of those points, both X (input) and Y (display), have been entered.

Changing Linearization with using Display Scaling
It is possible to change the absolute linearization values by changing the display zero and full scale (see page 24). DO NOT, however, CHANGE THE INPUT SCALING once linearization values have been entered.

Note:
If INPUT SCALING is changed (sub-menu on page 22) at any time AFTER linearization is entered (sub-menu on page 25), a "TABL ERR" message will be returned upon SPA startup.

To reset after a "TABL ERR" message, change any INPUT SCALING so that it follows all RULES (shown at left), then either exit the Configuration Menu, or cycle power to the SPA.

It is possible to change the display scaling of the SPA (sub-menu on page 24) at any time. Effecting a display scale change automatically changes the values of the Y axis in the linearization curve. It is not necessary to re-configure the linearization curve.

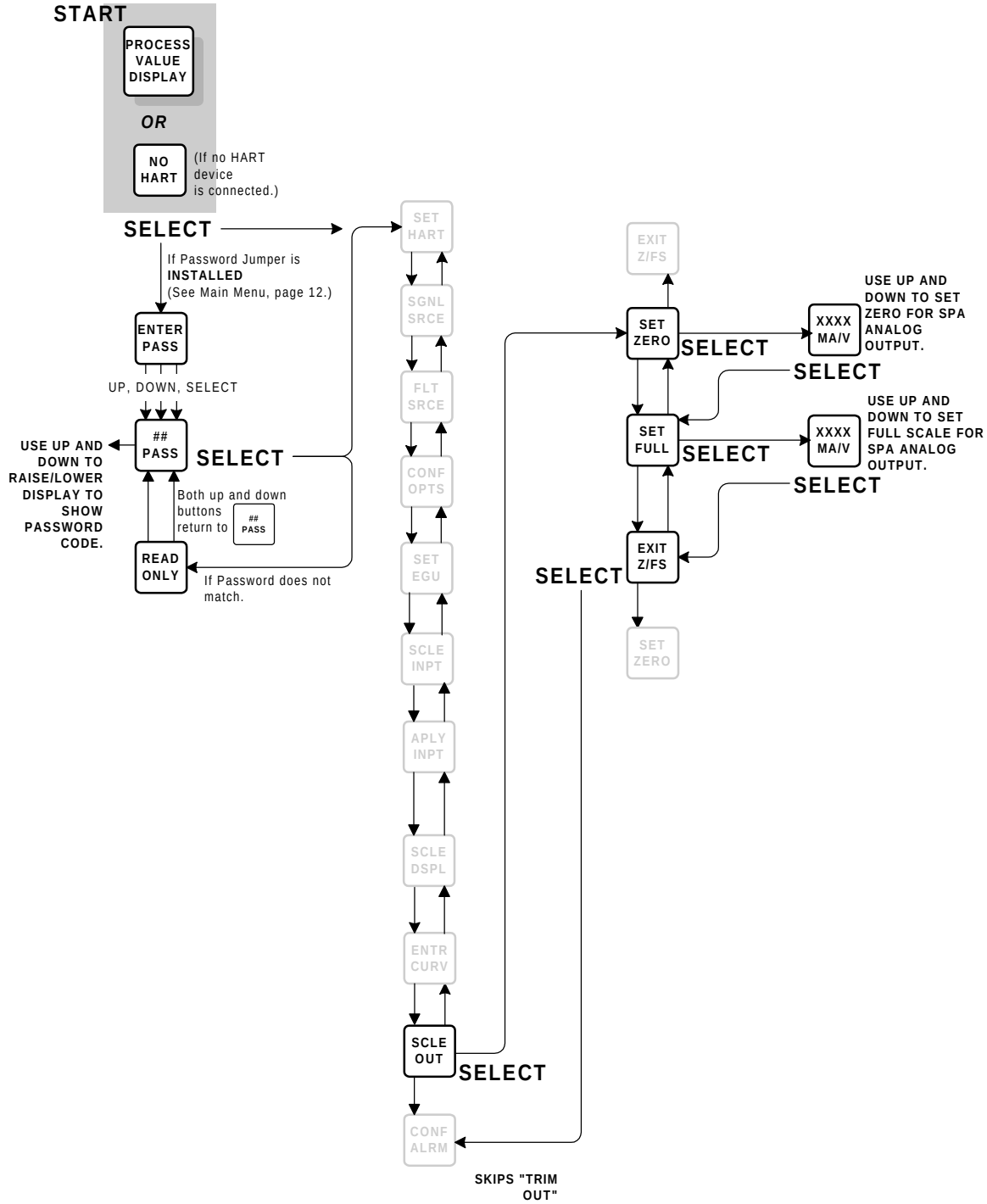
Note:
Remember! Though the SPA trip points, deadbands, and any output scaling setting are based on the display of the process value input, changing the Display Scaling DOES NOT AUTOMATICALLY CHANGE THE OTHER SPA SETTINGS (other than the linearization curve points' Y axis).

SCLE OUT SPA Setup — Smart Scaling SPA Analog Output

If your SPA is not equipped with the -AO option, skip this section.

If your SPA is equipped with optional analog output, you can enter a scaled range (by entering zero and full scale values) within the 0-20mA or 0-10V range, simply by using the front panel push-button. It is not necessary to connect the SPA to a source of input or to a meter to Smart Scale SPA Analog Output. Figure 20 shows the menu.

Figure 20. *Entering Scaling Values for the SPA Analog Output*



TRIM OUT SPA Setup — Trimming the SPA Analog Output

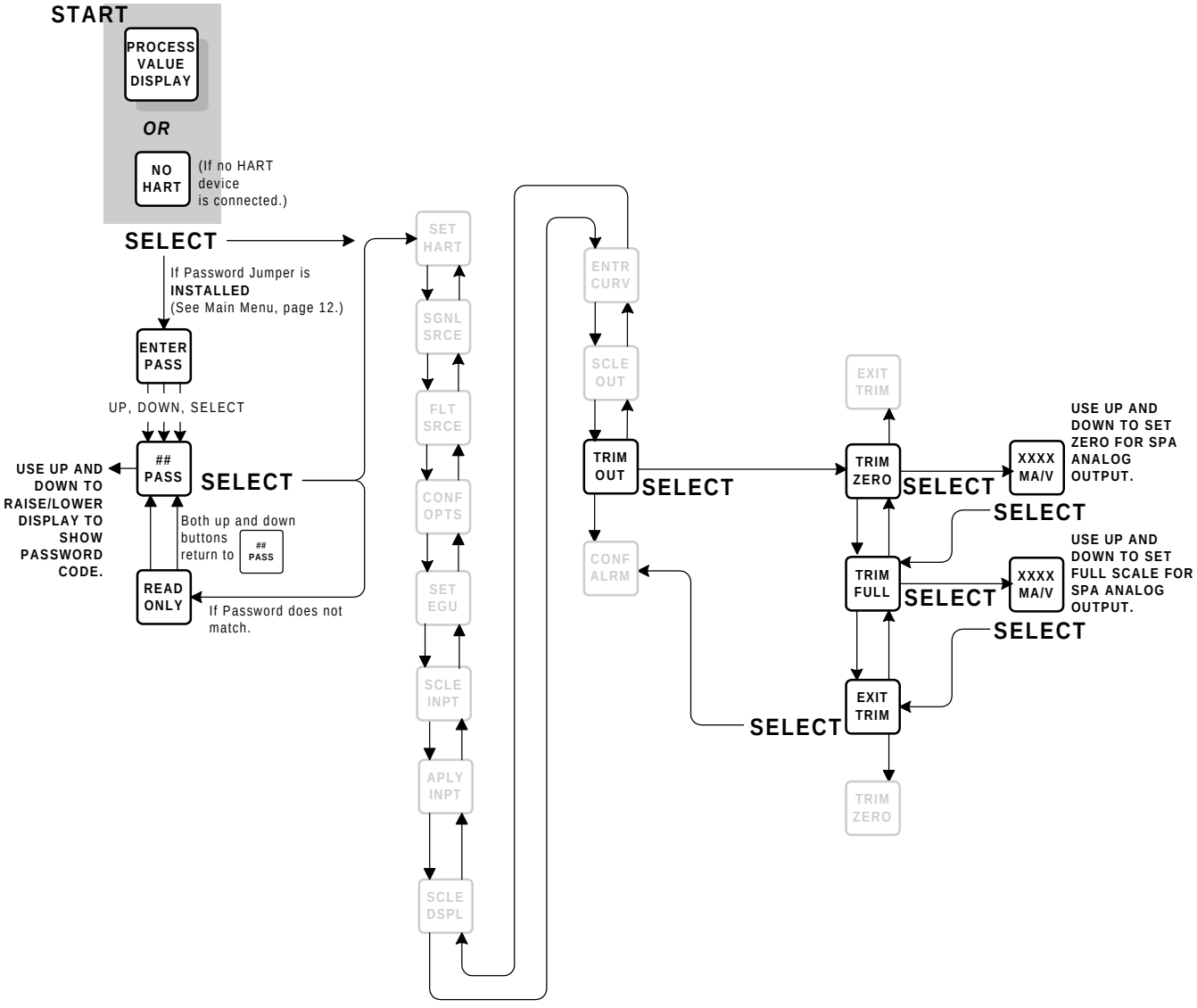
Skip this section if the SPA being calibrated does not have the -AO option.

Caution:
Trimming the Analog Output of the SPA nulls any scaling that may have been entered in the "SCLE OUT" sub-menu.

Refer to Figure 21. Trimming the SPA output requires the use of a meter to monitor the SPA output. To trim SPA output, compare the SPA's output display to the actual output shown by the meter reading. Then use the SPA UP or DOWN push buttons to raise or lower the output of the SPA until it matches that shown on the meter.

Press the SELECT push button to capture the output setting.

Figure 21. *Capturing Output Trim Settings*



SPA Setup — Configuring the SPA Relays

This is the sub-menu whose settings control Trip Point(s), Delay, Hi/Lo Functioning, and Latching/Non-latching operation of the SPA relays. Figure 22 shows the first part of the sub-menu.

If Relay #2 is configured as a SPA "Health" alarm (refer to page 19, Figure 13), use this part of the sub-menu to enter the parameters for Relays #1 and #2. If Relay #2 is set to trip on a Process Input value, refer to Figure 23 when configuring the operating parameters. Refer to Figure 23 to configure the parameters of relays #3 and #4 too.

Figure 22. *Configuring SPA Relays #1 and #2 (when #2 is configured as a SPA "Health" Alarm)*

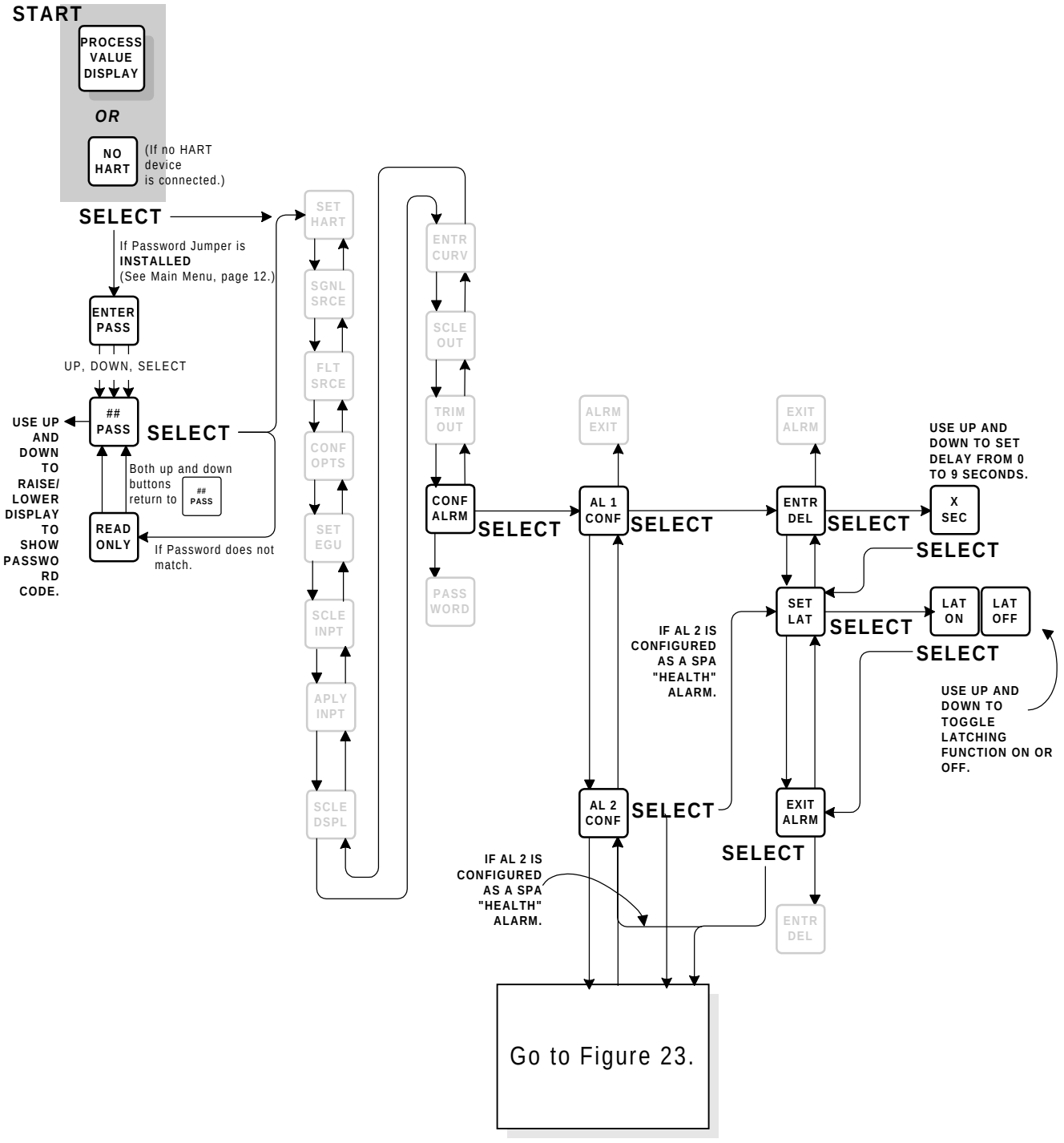
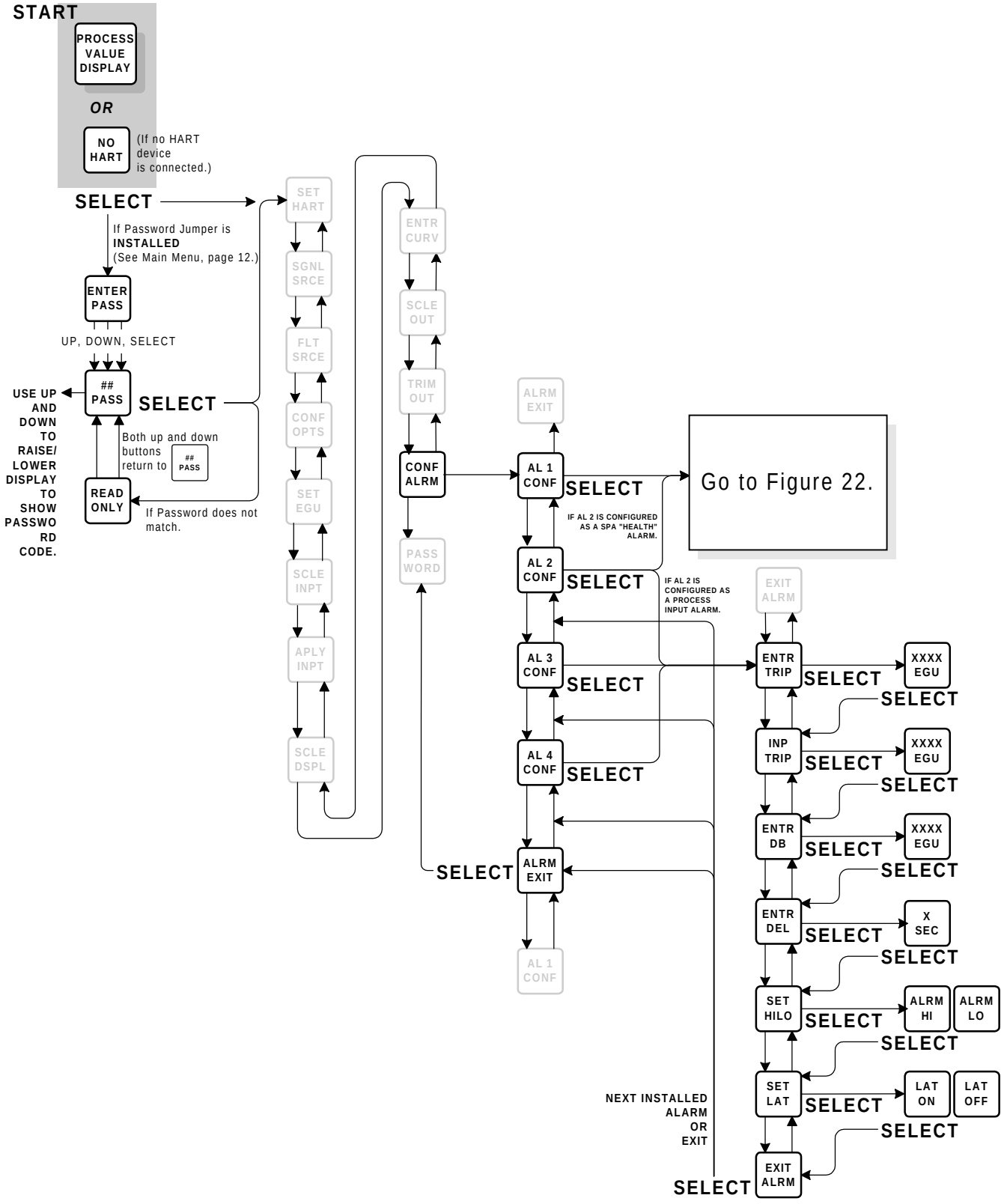


Figure 23. *Configuring SPA Relays #2, #3, and #4 (when #2 is configured as a Process Input Alarm)*



ENTR DEL AL 1 & AL 2 Config — Setting Alarm Delay

With this parameter, the user can set delays from 0 to 9 seconds. This is the delay from the time the SPA detects a fault until it changes the state of the relay(s).

SET LAT AL 1 & AL 2 Config — Setting Latching/ Non-Latching Alarm Function

Both latching and non-latching alarms change state when an alarm condition is detected. The difference between the two types of alarm is how they are *reset*.

Assuming that the monitored input returns to a non-alarm condition (including deadband), a Latching alarm relay requires that the Manual Reset Terminals be shorted ***and released*** before returning to a non-alarm state. The SPA has two labeled reset contacts on the top row of terminals. These can be connected to a switch or push button (not supplied).

A Non-Latching alarm relay, on the other hand, returns to a non-alarm state as soon as the alarm condition on the input is cleared. No manual reset is required.

ENTR TRIP AL 2, 3, & 4 Config — Entering Trip Points

Smart Ranging. This part of the sub-menu is used to enter the relay trip point(s) into SPA memory. Pressing the SELECT button from this point brings up a display of showing a value with the engineering units for the relay being configured, as selected in the "SET EGU" sub-menu, page 21.

Use the UP and DOWN arrow push buttons to change the display to the value required for the relay being configured. Press SELECT to enter the value into SPA memory.

Note:
It is not necessary to provide a source of HART input to the SPA when using the Smart Ranging capability.

If the trip point for a relay is entered into memory using Smart Ranging, the sub-menu for Standard or Bench Ranging is skipped.

CAP TRIP AL 2, 3, & 4 Config — Capturing Trip Points

Bench or Standard Ranging. This part of the sub-menu is used to capture (vs. enter) relay trip point(s) into SPA memory. If using this procedure, a source of HART input is required.

To use Bench Ranging, the HART input device is adjusted to the desired trip point, and the SPA SELECT push button is pressed to capture the reading.

Note:
The UP and DOWN push buttons are inactive at this point in the sub-menu.

ENTR DB AL 2, 3, & 4 Config — Entering Alarm Deadband

This part of the sub-menu is used to enter a deadband around a trip point setting. The SPA displays the value in the engineering units selected for the relay being configured, and the UP and DOWN push buttons are used to raise and lower the value as desired.

Press SELECT to enter the displayed value into SPA memory.

Note:
Relays configured with latching ON require Manual Reset. Manual Reset does not work until the process input has passed out of the deadband.

ENTR DEL AL 2, 3, & 4 Config — Entering Alarm Delay

With this parameter, the user can set delays from 0 to 9 seconds. This is the delay from the time the SPA detects a fault until it changes the state of the relay(s).

SET HILO AL 2, 3, & 4 Config — Set High/Low Alarm Function

Use the UP or DOWN push buttons to toggle this parameter either HI or LO.

HI-configured relays change state whenever the process input reaches or exceeds the trip point setting.

LO-configured relays change state whenever the process input reaches or drops below the trip point setting.

SET LAT AL 2, 3, & 4 Config — Set Latching/ Non-Latching Alarm Function

Both latching and non-latching alarms change state when an alarm condition is detected. The difference between the two types of alarm is how they are *reset*.

Assuming that the monitored input returns to a non-alarm condition, a Latching alarm relay requires that the Manual Reset Terminals be shorted ***and released*** before returning to a non-alarm state. The SPA has two labeled reset contacts on the top row of terminals. These can be connected to a switch or push button (not supplied).

A Non-Latching alarm relay, on the other hand, returns to a non-alarm state as soon as the alarm condition on the input is cleared. No manual reset is required.

PASS WORD SPA Setup — Setting or Changing the SPA Password Code

This sub-menu is only accessible when the internal Password Jumper is in the OFF or STORED position (refer to Figure 2 on page 7), or when the correct password code is entered in the Main Configuration menu when prompted at:

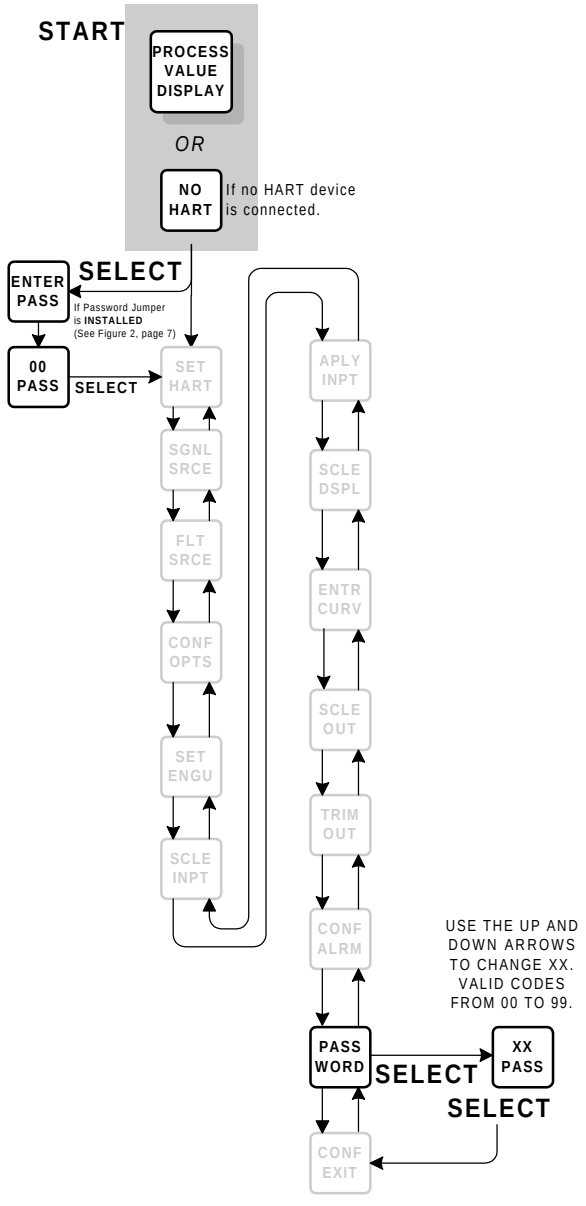
ENTR PASS

Figure 24 shows the sub-menu. The Password sub-menu works with the internal Password Jumper to allow the user to set up "protection" for operating parameter settings against inadvertent tampering once the SPA is installed.

Note:
The internal Password Jumper must be in the OFF or STORED position,
or
The correct, existing Password Code must be entered in the Main Configuration menu in order to view or change the Password Code.

Failure to enter the correct code automatically puts the SPA menu system into "READ ONLY" mode, wherein settings (except for the Password Code) can be viewed, but not changed.

Figure 24. *Viewing or Changing the SPA Password Code*



Installation

When all of the internal and menu settings for the SPA have been checked and/or changed as needed, the unit is ready to be installed. The installation of Moore Industries products generally consists of physically mounting the unit(s) then making connections to other instruments and power.

Note:
*Moore Industries recommends that the SPA be physically installed in its intended application **before** making any electrical and/or signal connections.*

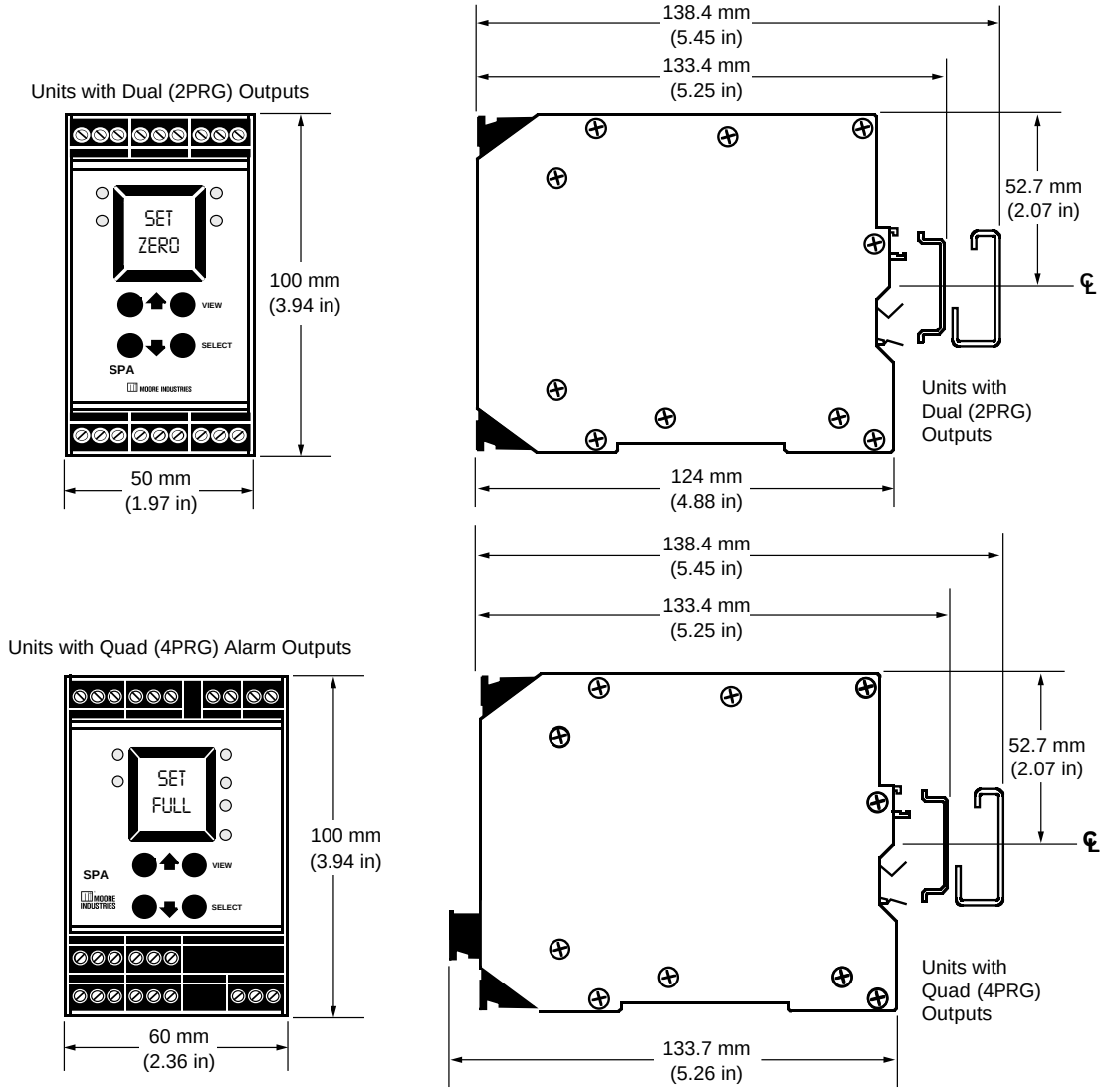
Make sure to follow any local regulations regarding the installation of electronic equipment, especially in hazardous or intrinsically safe applications.

The SPA is housed in a universal, DIN-style case. Its back panel is equipped with fittings that make it possible to mount the unit on either 32mm, G-type (EN50035) or 35mm Top Hat (EN50022) DIN rails.

Figure 25 shows the unit dimensions, including those for the both the 2PRG dual relay and the 4PRG quad relay variants.

Note:
To physically mount the SPA, it is necessary to pivot the unit upward, around the mounting clips on the back. When mounting more than one SPA in a cabinet or on a rack, make sure to allow adequate vertical spacing for pivoting the units to install and/or remove them.

Figure 25. *SPA with HART Dimensions*



Connecting the SPA

Figure 26 shows the SPA connected to a field device that is drawing power from the loop Primary Master, generically represented as a DCS.

Figure 27 shows how to hook up the SPA in an application where the HART field device is powered by the excitation capability of the SPA.

Refer to Table 2 for a summary of SPA terminal designations.

Grounding the SPA

Moore Industries provides the following guidelines for grounding the SPA in an applications. Further, the CE certification of the SPA in an application requires that these guidelines be followed in order for the unit to meet the specifications in EMC Directives EN50082-2 and EN55011.

Figure 26. *Connecting the SPA with HART to an Externally Powered Field Device*

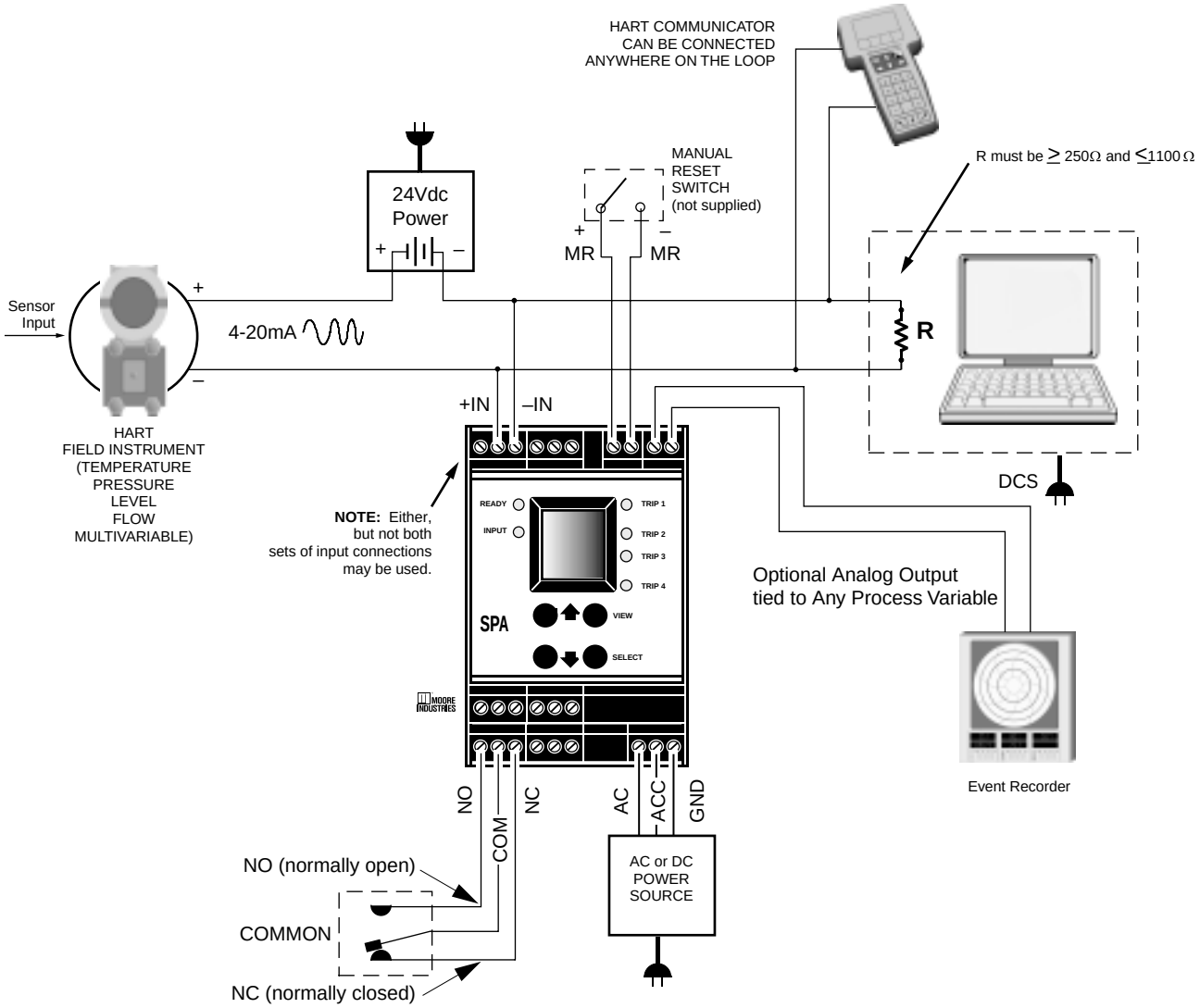
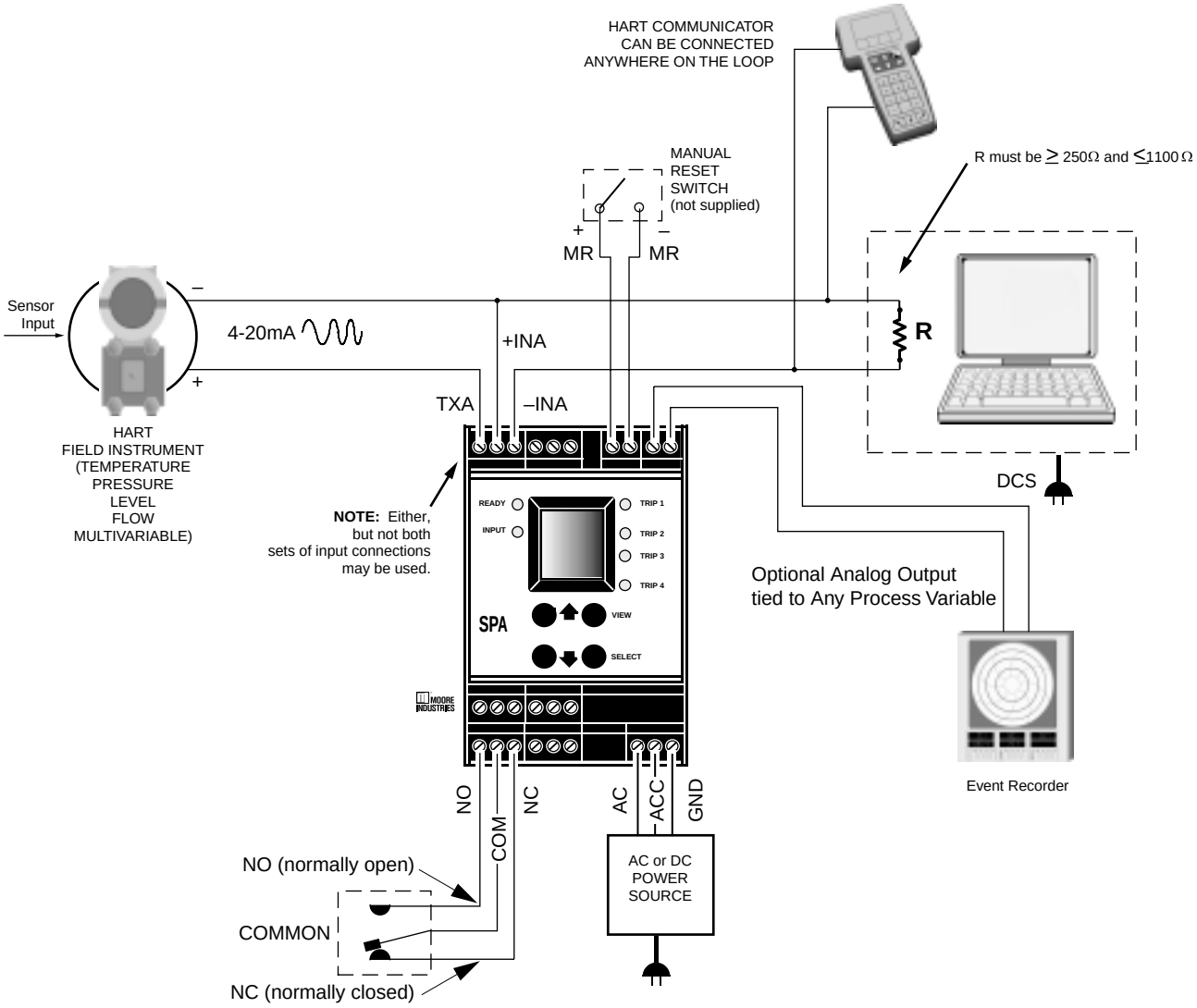


Figure 27. *Connecting the SPA with HART to a Field Device using the SPA's Transmitter Excitation Feature*



Housing

The metallic case of the SPA must be grounded. This can be achieved by mounting the unit on a grounded DIN-style rail.

A protective earth conductor should be supplied for each installation of SPAs. It should be of equal or larger size wire than any power-conducting wires in use.

Wiring

Twisted pair, shielded wiring should be used for all inputs and output signals. Shields should be grounded at the unit to earth (safety ground). Any unshielded part of input/output wiring should be no longer than 51 mm (approximately 2 inches).

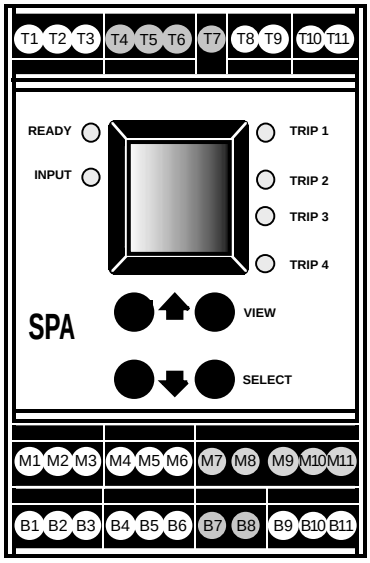
The protective earth conductor should be the first thing connected to the SPA as part of the installation, and the last thing removed if the unit is being taken out of service for any reason.

Table 2. *SPA with HART Terminal Designations*

Input	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11
HART	TXA	+INA	–INA	not present	not present	not present	not present	MR	MR	+AO	–AO
Output	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**	**M11**
DUAL Alarm (2PRG) with -DPDT Option	NO2	CM2	NC2	NO2	CM2	NC2	not present				
	↑ RELAY #1 ↑			↑ RELAY #2 ↑							
QUAD Alarm (4PRG)	NO3	CM3	NC3	NO4	CM4	NC4					
	↑ RELAY #3 ↑			↑ RELAY #4 ↑							
Output/Power	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**B9**	**B10**	**B11**
DUAL Alarm (2PRG) with or without -DPDT Option	NO1	CM1	NC1	NO2	CM2	NC2	not present		POWER AC DC	POWER AC DC	GND
	↑ RELAY #1 ↑			↑ RELAY #2 ↑							
QUAD Alarm (4PRG)	NO1	CM1	NC1	NO2	CM2	NC2	not present		POWER AC DC	POWER AC DC	GND
	↑ RELAY #1 ↑			↑ RELAY #2 ↑							

KEY:

MR = Manual Reset
AO = Analog Output
INA, INB = Input from HART Transmitter
GND = Ground
NO# = Normally Open
NC# = Normally Closed
TXA, TXB = Excitation for 2-wire HART Transmitter
CM# = Common



Other Notes on Connecting the SPA

The SPA must be configured to function as the Primary/Secondary HART master compliment to the other HART master in the loop; that is, if the DCS or HART Communicator in an application is configured as the Primary Master, then the SPA must be configured as the Secondary. If the DCS or Communicator is configured as the Secondary, then the SPA must be the Primary.

The total resistance in the loop must always be maintained between 250 and 1100Ω for optimum HART communication performance. Remember too that the SPA can be connected to only one HART field instrument. Do not use the SPA in a multidrop scenario.

Both Figure 26 and Figure 27 depict a hand-held HART Communicator. This is optional, and not supplied by Moore Industries, but may be used in the loop without affecting SPA operation. If a communicator is used in the loop, it should also be configured to operate in the “opposite” mode (with respect to Primary/Secondary HART Master) as the SPA.

Other SPA Installation Information

- SPA terminals are rated CAT II.
- All supply wiring connections should be made with 14 or 16 AWG (0.083 mm or 0.064 mm) wire. The ends of power conductor connections should be stripped no more than 8 mm (0.32 in). The stripped end of each wire should be tinned with solder, or inserted into a ferrule and crimped before being placed into a terminal block.
- The SPA does not generate hazardous voltages. Alarm contacts are wired in series with power sources and their intended loads. The correct load should be selected for the power source.
- The maximum working voltage for the contact-closure outputs of the SPA is 30Vdc.

Operation

Once connected to the HART Field device, a power supply, and the annunicators or other contact-closure-driven device(s) in the application, the SPA with HART begins to function according to its internal switch settings and the configuration stored in its non-volatile internal memory.

Changing Settings

Configuration data stored in SPA memory is monitored continuously. Changes to settings can be made at any time, though extreme caution should be exercised whenever making changes to parameters that could affect the process being monitored.

Caution:
Any changes made to operating parameters controlled by the settings in the SPA menu system take effect immediately. It is not necessary to exit the Configuration menu, or to cycle power.

Changes made to the SPA's internal DIP switch settings and security jumper do not take effect until power to the SPA is cycled off and on.

Caution:
Do not make changes to internal SPA settings when the unit is connected to power or to input.

LEDs

Each LED on the SPA front panel is labeled for a quick, visual reference for input condition and instrument "health" during normal operation. Here's what each LED means:

- **READY**
  GREEN DURING NORMAL OPERATION. This indicates that the SPA has run its start-up diagnostic routine, and that all internal circuitry is functioning properly.

  GOES OUT to indicate SPA FAULT. Relay #2 will parallel the state of this LED if configured to reflect SPA "health".

- **INPUT**
  GREEN DURING NORMAL OPERATION. This indicates that the SPA has established valid communications with the connected HART device.

  RED INDICATES HART FAULT. Typically, the loss of, or failure to establish communications with the connected HART device will result in this LED changing to RED state, and the LCD displaying a "NO HART" message.

- **TRIP #**
  GREEN WHEN RELAY IS IN A NON-ALARM STATE.

  RED INDICATES PROCESS INPUT FAULT (ALARM), relative to the trip point setting.

  TRIP 1 always monitors the state of the SPA-to-HART-device communications.
  GREEN INDICATES GOOD HART COMMUNICATIONS, RED INDICATES HART FAULT.

Important: Relays and LEDs—Working Together

It is important to note that the states of the Trip LEDs do not always indicate that their corresponding relay is energized or de-energized. The SPA LEDs are designed to indicate the state of the *alarm*, not the *relay*.

The state of SPA relays is determined by the settings for failsafe and non-failsafe operation.

Failsafe relays are ON (energized) whenever input is in a non-alarm condition. They are OFF (de-energized) whenever input is in an alarm condition.

LEDs complementing failsafe-configured relays will be GREEN whenever relays are energized (input is in NON-ALARM), and RED whenever relays are de-energized (input is in ALARM).

Non-failsafe relays are ON (energized) whenever input is in an alarm condition, OFF (de-energized) in non-alarm.

LEDs complementing non-failsafe-configured relays will be GREEN whenever relays are de-energized (input is in NON-ALARM), and RED whenever relays are energized (input is in ALARM).

Manual Reset

There are two connections labeled “MR” on the SPA top terminal block. These terminals work in conjunction with the latching/non-latching function set in the CONF ALRM sub-menu (page 30).

When the SPA is configured with latching alarms, an alarm condition will not “clear” or reset until:

- Input returns to non-alarm condition
- Manual Reset (MR) terminals are shorted and opened

Typically, some type of switch is connected to these terminals to facilitate quick alarm reset.

When the SPA is configured with non-latching alarm, an alarm condition “clears” or resets whenever the corresponding input returns to a non-alarm condition, as defined by the trip point, deadband, and alarm delay settings. No manual reset is needed.

Note:
Manual Reset clears (resets) all alarms.

Error Codes

Every SPA is subjected to an exhaustive batter of operational checks and tests prior to its shipment. Occasionally, however, units can sustain damage getting from the factory to the user.

As a safeguard, the SPA performs a full set of internal diagnostics that check operation and configuration upon power-up. If there are problems with the microprocessor, or with conflicting operating parameter settings, the unit LCD indicates a problem by displaying an error code. Table 3 lists those codes.

For most of these problems, it will be necessary to return the recalcitrant SPA to the factory. A quick call to the nearest Moore Industries STAR Center will have a temporary replacement unit en route right away.

Table 3. *Troubleshooting—SPA Error Codes*

Error Message	What it Means	What to Do
EE FLT	EEPROM Error - The internal processor failed	Cycle power to the unit, and if the error occurs again, return the unit to the factory for service.
RAM ERR	RAM(memory) Error - The internal processor failed	
ROM ERR		
CAL ERR	Calibration Error - The factory-set calibration of the unit has failed to initialize.	
DATA ERR	Data Error - There are conflicts in the settings entered into unit memory. This can be caused by power loss or fluctuation during power-up.	Cycle power to the unit, then run through the configuration menus to ensure that the technician made the correct sensor selections for the range settings, etc.
PACT ERR	Memory Packet Failure - Internal memory failure	Cycle power to the unit, and if the error occurs again, return the unit to the factory for service.
CONF ERR	Data Error - There are conflicts in the settings entered into unit memory. This can be caused by power loss or fluctuation during power-up.	Cycle power to the unit, then run through the configuration menus to ensure that the technician made the correct sensor selections for the range settings, etc.
TABL ERR	Internal Table Error - The linearization curve programming is not correct.	Make sure that the endpoints of the programmed curve are within the selected INPUT SCALING.

Declaration of Conformity

EMC Directive 89/336/EEC

Manufacturer's Name: Moore Industries-International, Inc.
Manufacturer's Address: 16650 Schoenborn Street
North Hills, CA 91343-6196
USA

Declares that the product(s):

Product Name: **SPA-HART**

	MODEL	/	INPUT	/	OUTPUT	/	POWER	/	OPTIONS	/	HOUSING
Model Number(s):	**SPA**		*		*		**24VDC**		**-CE**		*

*Indicates any output, option and housing as stated in the product data sheet.

Conforms to the following EMC specifications:

EN50081-1, 1992, Generic Emissions Standard, Residential, Commercial and Light Industry.
EN50082-1, 1992, Generic Emissions Standard, Residential, Commercial and Light Industry.

Supplemental Information:

None.

October, 24 1997
Date

Fred Adt
Quality Assurance Director

Robert Stockham
Moore Industries-International, Inc.

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RETURN PROCEDURES

To return equipment to Moore Industries for repair, follow these four steps:

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

   Warranty Repair –
   If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

   Non-Warranty Repair –
   If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
   a) A note listing the symptoms that indicate the unit needs repair
   b) Complete shipping information for return of the equipment after repair
   c) The name and phone number of the person to contact if questions arise at the factory

3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.

4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

WARRANTY DISCLAIMER

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ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY AGREES WITH THE COMPANY THAT THE SOLE AND EXCLUSIVE REMEDIES FOR BREACH OF ANY WARRANTY CONCERNING THE GOODS OR SERVICES SHALL BE FOR THE COMPANY, AT ITS OPTION, TO REPAIR OR REPLACE THE GOODS OR SERVICES OR REFUND THE PURCHASE PRICE. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES EVEN IF THE COMPANY FAILS IN ANY ATTEMPT TO REMEDY DEFECTS IN THE GOODS OR SERVICES , BUT IN SUCH CASE THE BUYER SHALL BE ENTITLED TO NO MORE THAN A REFUND OF ALL MONIES PAID TO THE COMPANY BY THE BUYER FOR PURCHASE OF THE GOODS OR SERVICES.

ANY CAUSE OF ACTION FOR BREACH OF ANY WARRANTY BY THE COMPANY SHALL BE BARRED UNLESS THE COMPANY RECEIVES FROM THE BUYER A WRITTEN NOTICE OF THE ALLEGED DEFECT OR BREACH WITHIN TEN DAYS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH, AND NO ACTION FOR THE BREACH OF ANY WARRANTY SHALL BE COMMENCED BY THE BUYER ANY LATER THAN TWELVE MONTHS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH.

RETURN POLICY

For a period of thirty-six (36) months from the date of shipment, and under normal conditions of use and service, Moore Industries ("The Company") will at its option replace, repair or refund the purchase price for any of its manufactured products found, upon return to the Company (transportation charges prepaid and otherwise in accordance with the return procedures established by The Company), to be defective in material or workmanship. This policy extends to the original Buyer only and not to Buyer's customers or the users of Buyer's products, unless Buyer is an engineering contractor in which case the policy shall extend to Buyer's immediate customer only. This policy shall not apply if the product has been subject to alteration, misuse, accident, neglect or improper application, installation, or operation. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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Specifications and Information subject to change without notice.

MOORE INDUSTRIES

User's Manual Supplement

SPA (HLPRG) and SPA HART
Transmitter Excitation (TX) Power Supply

January 2006

The information contained within this document affects the following user's manuals: SPA (HLPRG) 224-715-00, Revision B and SPA HART, 224-741-00, Revision D.

This supplement has been issued to provide Transmitter Excitation (TX) Power Supply information and specifications which were not included in the SPA (HLPRG) and SPA HART User's Manuals.

Power Supply:

U (Universal): 22-300Vdc or 90-260Vac
CE Unit: 117Vac or 230Vac, ±10%, 47-63Hz.
The CE version is built to order. A change in the voltage requires a change in fuse value.

Power Consumption:

U (Universal): 2 to 3W, nominal, including use of TX
CE Unit: 2.5 to 4W, nominal, including use of TX

TX Power Output:

Transmitter excitation power of 24Vdc, ±10%@24mA is provided at the terminals marked *TX*.

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